THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE NEW ARTICLES OF THE I.E E.

THE new Articles of Association of the Institution of Electrical Engineers have now been circulated to the members, and notice has been given that an extraordinary general meeting will be held on May 9th, before the ordinary meeting, to consider the adoption thereof. If approved, the new scheme will come into force on July 1st.

In the main, the revised version follows the lines of the Articles proposed in November last, when the short time allowed for their consideration, and the drastic changes involved for which the minds of the members had not been adequately prepared, led to an ebullition of criticism and objection that necessitated the withdrawal of the proposals. Since then the President and Council have afforded the members both in London and at the provincial centres abundant opportunity for thoroughly thrashing out the matter and expressing their views, and the various suggestions made by the members have been taken into account in formulating the new version.

Although it was both unexpected and undesired, the animated discussion which arose has undoubtedly borne fruit. Never before, it would seem, has the Institution been so deeply moved throughout its mass, or have its Articles been so keenly scrutinised and debated. We may safely say that the members know a great deal more about their association than they ever did previously, and the result has been a magnificent advertisement for its aims, its benefits, and its possibilities. Allowance must be made for the beneficial influence of the broader policy inaugurated by Mr. Ferranti, the effects of which upon the membership began to make themselves felt a year ago; but it cannot be doubted that a considerable proportion of the great increase in the number of members during the past six months is due to the agitation over the new Articles. Thus, that which seemed a misfortune at the time has proved to be a blessing in disguise; and the very fact that new members have been rapidly enrolled, in the face of the certainty that a new code of Articles not greatly differing from the earlier proposals would shortly be adopted, is satisfactory evidence that the latter were framed approximately on the right lines.

As all the members of the Institution have doubtless received copies of the revised version of the Articles, we need not review these in minute detail, except in so far as may be desirable for the information of non-members, especially those who may be prospective members. The new classification has been adopted practically as proposed, except that for "Licentiates" has been substituted the title "Graduates," admittedly an unsatisfactory term, but apparently the last resource. Candidates for Associate Membership may be required to pass an examination; they need not be actually engaged in electrical engineering, provided that they have been properly trained as electrical engineers

and are engaged in some branch of engineering. Electrical engineers can no longer enter the Associate class, which will be reserved for eminent persons connected with electrical engineering; special facilities are given for others who are now in that class to be transferred to the class of Associate Members or Graduates, according to their qualifications, and all proposals for transfer will, in future, be submitted to a ballot of the members as in the case of election of new candidates.

Important modifications are made in connection with subscriptions. All existing Members, Associate Members and Associates will pay half a guinea more after this year, and all admitted after December 31st will pay one guinea more than the present rates. Graduates will pay two guineas. Whilst abroad Members, Associate Members and Associates will contribute somewhat less than home members, but no distinction is made between town and country members. The new scales of fees are in fair accordance with those of the Institutions of Civil and Mechanical Engineers. Members elected after July 1st in any year will in future pay only half the subscription for that year. The entrance fees are raised all round, from January 1st, 1913. Life Compositions in future will be on a sliding scale varying with age.

An important change is made in the procedure of election of Council. Facilities are provided for external nominations, but in any case the Council's own nominations must exceed the number of vacancies by two names at least, rendering a ballot obligatory; moreover, a postal ballot will be taken. Thus for a lifeless formality, whereby to all intents and purposes the old Council nominated the new Council, will be substituted a real election, and it cannot be doubted that the interest of the members will be greatly stimulated thereby, while in addition the successful candidates will feel that they truly represent and are directly responsible to the members—a valuable result, which under present conditions is not attained.

Other changes are made, which less closely affect the prospective member, being of a more or less domestic nature. Reviewing the whole scheme, we feel that a very satisfactory compromise has been effected, which should command the approval of the members. We formed and expressed a favourable opinion on the original proposals, with the exception of certain items, and in the revised code the latter have been amended. We hope that the scheme will go through, and that the Institution will enter upon a new era of prosperity, thanks in great measure to the splendid efforts of the President to arouse the Institution to a realisation of its magnificent possibilities.

We understand that the election this year, as it happens, will not lack the interest of a contest, for Mr. W. Pollard Digby has been nominated as candidate for the Associate Member's seat on the Council, necessarily in opposition to Mr. A. Bruce Anderson, the official nominee. Mr. Digby is proposed by Messrs. F. E. Benest, of the India Office, and Julius Frith, of Manchester, and supported by a number of well-known engineers. Incidentally we notice that such nominations, whether under the existing or new Articles, can only be made and supported by full Members, so that the Associate Member and Associate classes, which also rank as Corporate Members, and will have each three seats on the Council, will be debarred from nominating their own representatives. This appears to be a rather unfortunate disability.

It is not the intention of Mr. Digby's supporters to carry on a vigorous election campaign, so that the issue will be quietly determined by the members according to their individual inclinations; nor do we propose to express any opinion respecting the merits of the rival candidates. We welcome the fact of an external nomination, however, conducted on these lines, as a foretaste of the conditions that will obtain under the new Articles; the contest will appeal to the sporting instincts of the members, and the result will not, as usual, be absolutely devoid of interest.

The I.E.E. Presidential Election.

As we announced in our last issue, the Council of the Institution of Electrical Engineers has nominated Mr. W. Duddell for election to the Presidential chair in succession to Mr. S. Z. de Ferranti. We greatly regret that an electrical contemporary has thought fit, in commenting on this, to make an unwarranted attack upon Mr. Duddell, and to urge that Mr. Ferranti should have been re-elected for a third term of office.

In saying this, we would not be misunderstood. The policy inaugurated by Mr. Ferranti has commanded our whole-hearted support, and we cordially trust that it will continue to be followed by the Council until his aims have been fully attained. But those who know with what assiduity of labour, and at what cost in the sacrifice of precious time and personal convenience, Mr. Ferranti has sustained the burden of office during the past two years, cannot but recognise that to call upon him to undergo a third term would be a gross imposition upon the good nature and public spirit of a man to whom the industry is already most deeply indebted. While we heartily endorse all that our contemporary says in his honour, we feel that Mr. Ferranti has earned a rest.

But as regards his successor, who has been a vice-president of the Institution for some years and has repeatedly presided at the ordinary meetings, we unhesitatingly join issue with our contemporary, which suggests that Mr. Duddell is practically unknown to the electrical world, and that his nomination to the presidency represents "a decided check to the 'broader policy' movement." Those who are better informed than the writer of the article in question are aware that the President-Designate, though comparatively young, already has a distinguished career behind him, and has attained an international reputation as a scientific but essentially practical engineer and inventor; moreover, as a man of culture and *savoir-faire*, a linguist of exceptional ability, and a ready speaker, he possesses admirable qualifications for the presidential chair; and from the businesslike way in which he has conducted the proceedings whilst acting as chairman at the meetings of the Institution, there is every reason to anticipate that efficiency and expedition will be the dominant features of his *régime*. The Council has abundantly manifested its approval of the policy inaugurated by Mr. Ferranti, and has thereby earned the approbation of the general body of the members, and we see no reason whatever to suppose that the election of Mr. Duddell will in any way tend to the reversal of that policy. Our contemporary grudgingly admits at the end of its diatribe that all may be well in spite of its gloomy forebodings, and we think it unfortunate that the latter should have found expression.

The Loss of the "Titanic."

The desolating catastrophe which has befallen the *Titanic* has created the profoundest sorrow and dismay in every section of the general public; and in all ranks and classes of engineers these expressions of regret are intensified by the circumstance that the calamity has descended upon shipbuilding at the very hour of its supreme triumph. In order to keep pace with the world's industrial development, trade demanded ocean-going vessels of increased speed and capacity. The skill and energy of mankind were accordingly concentrated upon the task, and in the natural process of evolution, under modern conditions of technical knowledge, a fleet of mammoth high-speed liners has been made and launched. There is no stemming back the tide of this constructional evolution, for it is overwhelming. Deep calleth unto deep, and the forces denoted by that cry and by the response to it are continuous and, in the measure of

man, invincible. They are nothing less than the life forces of engineering and industry. For the moment they have been rudely checked, and it is desirable at such a time to revise opinions and to take bearings. It may be necessary, for other reasons than the loss of the *Titanic*, to moderate the dimensions of ocean-going liners, and to reform the departments responsible for the issue of rules and regulations affecting the safety of passengers at sea; but the disaster must not be hurriedly construed as an argument against the policy of constructing big ships. The real point at issue is whether, upon the basis of the whole passenger traffic, such vessels result in greater or less safety to passengers. Legislation formulated upon bad exceptions makes exceptionally bad law. Future policy regarding shipbuilding should therefore be governed upon principles deduced from the broad results of experience over a term of years. Let it be remembered that the *Titanic* did all that is to be expected of a vessel in such dire circumstances—she floated and she kept a sufficiently level keel for ample time to have enabled her passengers and crew to be transferred to boats, if boats had been available. The ice dealt her a murderous blow, probably ripping up her side, along her most vulnerable line, near her bilge-keel, and extending probably between several bulk-heads, letting the water into her limbers. It was a hurt that neither storm, shot, rock nor collision could perhaps have done to her, and against which all the skill of designers must necessarily have failed. It brings home to us the proportionality of things, and the fact that the sea-going life and wealth of the world to-day depends, for the most part, upon a few rivets and a film of mild steel.

Australian Labour Questions.

At the eight annual conference of the Associated (Australian) Chamber of Manufacturers recently held at Sydney, some interesting figures as to the position of Australian manufactures at the end of the year 1910 were given. With a population of 4,425,083, the number of factories was 13,822, and the total persons employed were 286,831, or an average per factory of about 29 persons. The salaries and wages paid were £23,874,959, an average of about 32s. per week. The total value of the output was £120,770,674, so that the wage bill represented about 20 per cent., or one-fifth of the total sum.

During the conference a discussion took place on the "Preference to Unionists" principle which is being actively advocated by the Trade Unions of the Commonwealth. The particulars which we give in another column as to the conditions of labour amongst tramway employés show to what lengths labour demands may be carried. Mr. Martyn, who opened the discussion, stated at the outset that manufacturers would, doubtless, sympathise with the aim of the old Trade Unionism, which had for its basic principle the preservation of the interests of the men. It was, however, a far cry from this to the present labour policy, which demanded a controlling interest in industrial undertakings without taking any corresponding risks. In his opinion, the existing system was nothing more or less than handing over the government of the country to miners taken from the mine and carpenters from the bench, men who had no experience in economics or in matters of government. While no business men would entrust the conduct of their own businesses to such untrained leaders, they were given the control of national policy. He felt that the enforcement of the present demands of Trade Unionism would ultimately mean a general increase of prices to the consumer, while at the same time it would impair the personal liberty of opinion of the individual.

We are not surprised at this expression of opinion. The claims of the Trade Unions to dominate the conditions of employment could only be justified if they were prepared to participate in the risks of commercial competitive enterprises, and there is up to the present no evidence that they are willing to look upon the industrial problem from this standpoint.

A further resolution was adopted, stating that in regard to work carried out by Federal and State Government departments, it was absolutely necessary in the public interest that a proper system of recording costs should be adopted, and that in all cases when Government Departments competed with private enterprise, profit and loss accounts should be annually published, in which allowances were made for depreciation of plant and buildings, interest on invested capital and other usual business charges.

We are of opinion that such balance-sheets are wanted, not only in Australia, but nearer home, for while some of our own publicly-owned undertakings would come unscathed, or indeed with enhanced reputation, out of the ordeal, there are many which would be proved to be utterly unsound financially. A clear statement of facts would prevent much of the generalising as to the advantages of State and municipally owned enterprises which is so prevalent to-day.

Electrical Engineers and State Employment in Germany.

A complaint is being made in electrical engineering circles in Germany because electrical engineers who have obtained diplomas at the Technical High Schools are not permitted to enter for the government examination for the class of technical officials who are termed "regierungs baumeister." It would seem that only those who have passed this examination may hope for employment in technical work for the government in connection with the State railways, workshops, lighting and power plant, potash and coal mines, &c. In 1909 the government of Saxony approached the Prussian Minister of Public Works on the question of the admission of diploma-holding electrical engineers to the State examinations for baumeister, but the reply received intimated that mechanical problems preponderate in the electrical services of the State, and that the possibility of transference to another department has to be reserved in the case of the high technical officials.

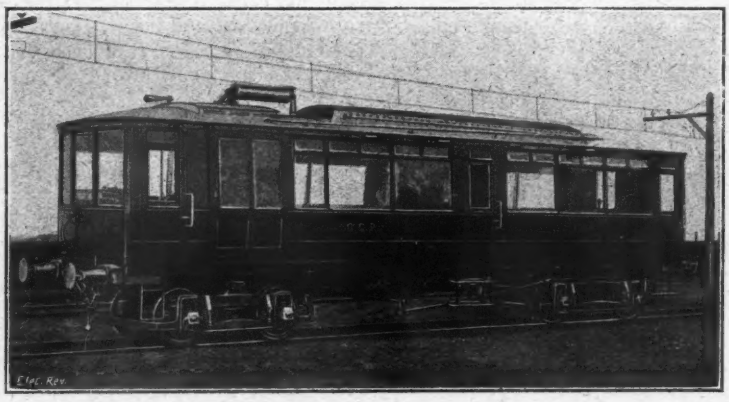
It is, however, contended in electrical circles that as the construction of electrical machinery has in the meantime developed into a substantial portion of the total business in machine construction, the former now has a just claim for special consideration in the matter. As far as the education of future State technical officials is concerned, it seems that up to the time of the preliminary examination for a diploma, the intending mechanical engineer and the electrical engineer receive exactly the same course of instruction at the Technical High Schools; and also after this particular examination, the difference between the two is not one of quality but one of quantity in the number of subjects. The mechanical engineer is then concerned more with the thermodynamic branches of machine construction, whilst the electrical engineer is naturally more interested in electrotechnical matters.

In any case the situation of the matter and the whole course of improvement at the Technical High Schools are such, it is held, as to render it desirable that equal rights should be granted to both classes, although it is agreed that the admission of electrical engineers to the examination for State technical officials would not carry with it any claim for Government appointments, as the latter would have, as hitherto, to be filled according to requirements. It is urged that the gradual transformation of steam lines to electric traction that is now taking place renders it all the more justifiable that electrical engineers should be received into Government service. The system adopted at present by the Prussian State Railway authorities, who have no certificated electrical engineers at their disposition, is to send baumeister in machine construction (mechanical engineers) to the large electrical firms in order to familiarise them with the construction of electrical machinery.

It is, however, urged that this system will be untenable in the long run, as these officials unconsciously become inculcated with a special preference for the types and methods of working of particular firms; and that it would be far better to admit electrical engineers to the examination in question, and for them, having a preliminary knowledge and capable of critical contemplation, to be sent to the manufacturing works of the large firms for the purposes of the Government.

WESTINGHOUSE PETROL-ELECTRIC CAR FOR THE G. C. RAILWAY CO.

The Great Central Railway Co. have recently ordered a standard 90-h.p. petrol-electric passenger coach from the British Westinghouse Co., Ltd., which has been under trial on the company's South Harrow line.



Westinghouse Petrol-Electric Coach for the G.C.R.

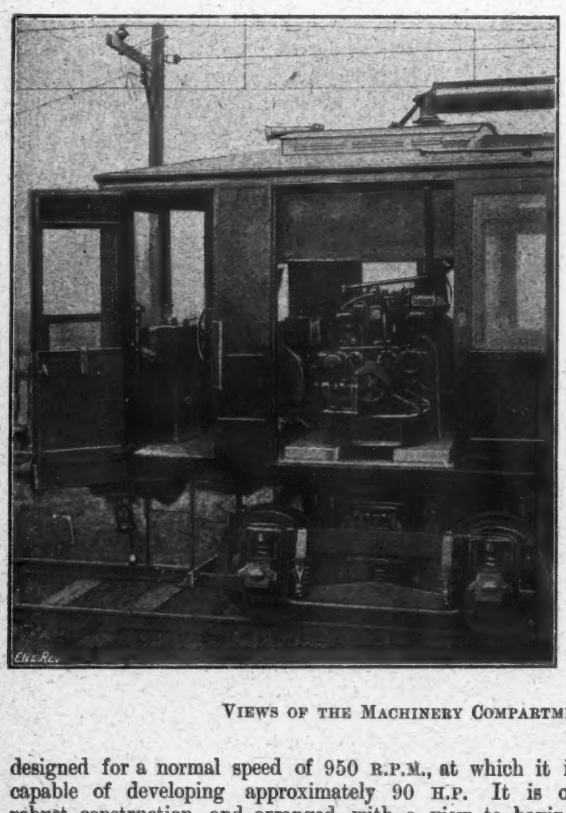
The car measures 41 ft. 6in. over the headstocks, is 8 ft. 6 in. wide over the pillars, and has a clear inside height of 7 ft. 6 in.; it is divided into four compartments — an engine compartment which contains the engine, generator, controller, instrument, brake and lighting set, together with the necessary fuel and water tanks, two middle passenger compartments to accommodate 50 passengers seated, with a middle entrance, and a small compartment for the driver's use containing only the controller, instruments and brake levers, although it can, of course, be used in addition for the storage of small articles of luggage.

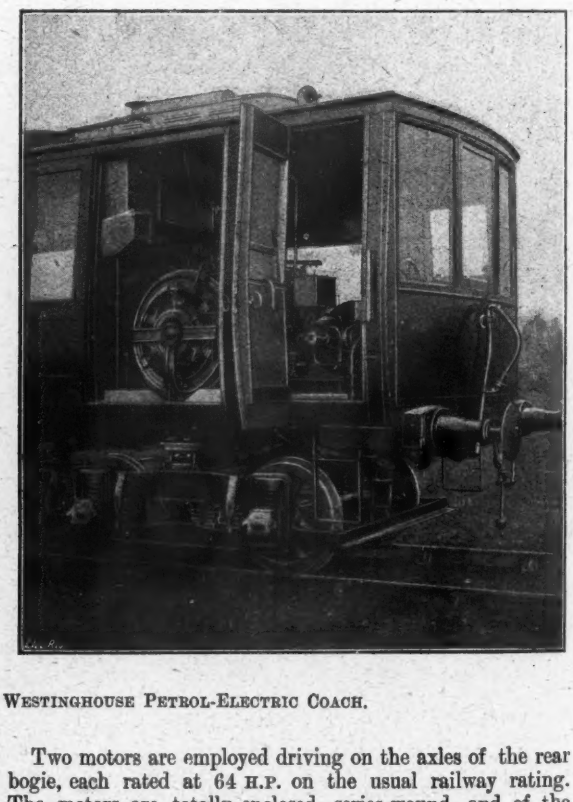
The engine operates on the four-cycle principle, has six cylinders of 140 mm. bore × 160 mm. stroke, and is designed for a normal speed of 950 r.p.m., at which it is capable of developing approximately 90 h.p. It is of robust construction, and arranged with a view to having all the parts as accessible as possible. A suitable governor is provided, and a flexible coupling connects the engine with its generator, which is of the shunt-wound type specially designed for this service, and provided with interpoles.

The control of the car is very simple, and is entirely by one handle. The controller has fingers and contacts of the tramway type, but is arranged so that the handle controls both engine and generator. The usual reverse lever is provided for reversing the direction of motion when necessary. An attachment is provided which renders it necessary for the driver to hold the controller handle continuously; if it should be released the power would be cut off from the motors. An advantage of this, often known as "dead man" control, is that should the driver be suddenly seized with illness or leave his position, power is cut off.

The control is capable of meeting the varied needs of the service without the use of series resistances, the regulation being entirely on the field of the generator, thus securing the maximum economy throughout the run. A single instrument is used for indicating the generator output in amperes, volts, and kilowatts. This is arranged very neatly by means of crossed fingers, and gives all the desired information in a very easily understood and exceedingly clear manner. A circuit-breaker in the motor leads will trip the circuit in case of excessive overload.

The drive may be made from either end of the car, and one man is sufficient for attending to the engine and for driving, thereby saving the cost of the additional man needed for stoking in a steam-propelled vehicle.





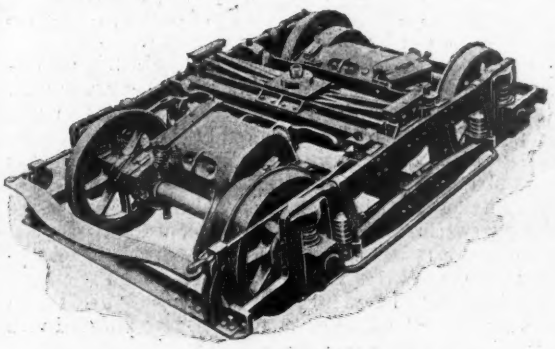
Views of the Machinery Compartment, Westinghouse Petrol-Electric Coach.

Two motors are employed driving on the axles of the rear bogie, each rated at 64 h.p. on the usual railway rating. The motors are totally enclosed, series-wound, and of the usual type supplied for direct-current railway working.

A separate petrol set is used for operating a vacuum exhauster and driving a small generator, which serves for providing electric lighting for the coach. This generator supplies current at 24 volts to the bus-bars of a small lighting board, provided with switches, fuses, and voltmeter, and the lamps are wired directly on to this in several circuits.

The car is not designed for higher speeds than 40 miles an hour, but will easily attain a speed of about 35 miles an hour on the level, and on the Harrow line, we understand it was allowed to reach a speed of 45 miles an hour.

An important advantage of this system is that during the starting period the full output of the engine may be obtained. This means a very heavy torque during starting and slow



Rear Bogie, with Motors, Westinghouse Petrol-Electric Car

running, resulting in rapid acceleration, a highly desirable feature for suburban and other short distance work.

The layover losses are entirely avoided, and the useful range of the vehicle may be anything desired, since fuel for very long journeys may be carried and the full power maintained continuously.

ELECTRICITY SUPPLY AT MEXBOROUGH.

The town of Mexborough (S. Yorkshire) has a population of about 14,000, mainly composed of colliers and tradespeople supplying the needs of the inhabitants and the surrounding locality. As will be seen later, the field for electrical enterprise is by no means favourable, yet development has exceeded all expectations, and the two 50-kw. generating units originally installed in 1902 are now replaced by four 100-kw. sets, which are, in turn, approaching their maximum output.

The present equipment comprises two three-crank Willans compound engines, direct-coupled to Mavor & Coulson six-pole dynamos, and two Belliss compound engines direct-coupled respectively to Mavor & Coulson and Siemens generators. The Willans engines exhaust to atmosphere *via* a feed heater (boiler feed being at 80° F.), but an ejector condenser can be coupled to either or both of the Belliss sets. Steam is supplied at 150 lb. per sq. in. from two Lancashire boilers, working in conjunction with a 100-kw. Meldrum destructor.

Owing to the cheapness of coal in the district, household ashes are seldom riddled, hence the town refuse is particularly rich in burnable material. Unfortunately, this advantage is at present offset by the peculiar daily load curve of the station which necessitates the destructor standing idle, with banked fires, for 14-16 hours per diem. From 3 a.m. or 4 a.m. in summer, or 8 a.m. in winter till 3 p.m. or 5 p.m., the whole station output is drawn from the storage cells. From 2 p.m. to 4 p.m. the destructor is brought to full heat, and then works at full load till about 12 p.m. During this shift one or two of the Willans engines and one of the Belliss sets are running, but from midnight to 8 a.m. one Belliss set supplies the external load and charges the battery. One set is at present available as spare plant. The low load-factor of the station (15·1 per cent.), hardly justifies the fitting of condensers to all the engines, but the condenser installed is always connected to the running Belliss engine, and is thus in use for 16 hours per day.

Water supply for condensing and feed purposes is taken from an adjacent canal (see fig. 1); before passing to the feed heater it is purified and softened in a Paterson plant treating 2,000 gallons per hour.

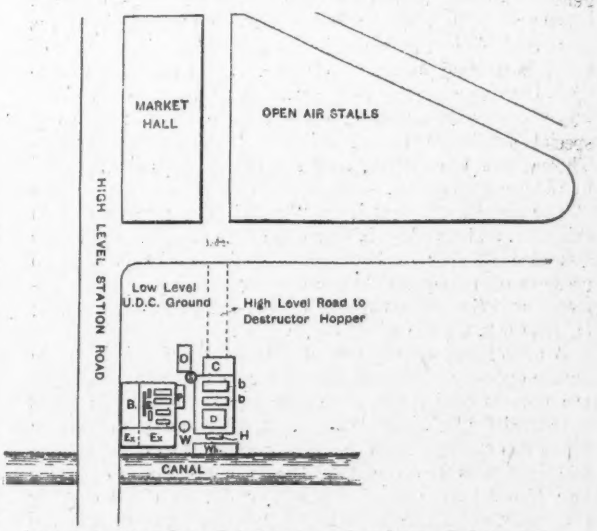
The original A.B.P. storage battery, after five years' satisfactory service, was replaced in 1907 by a set of Chloride cells, which, with the exception of a cleaning and the replacement of 100 negative plates, has required no attention since its installation. A 10 years' maintenance contract for 600 ampere-hours' capacity (at 6 hours), has been concluded with the makers. The actual present capacity is about 750 ampere-hours.

The 25-ampere booster-balancer, installed at the time the station was opened, has long been overloaded; it speaks well for its construction that over 80 amperes maximum out-of-balance current has been successfully handled by this machine for some time past. A 100-ampere Crompton booster balancer is, however, now being installed.

During the year ending March 31st, 1911, the maximum load recorded at the station was 240 kw., and considerable extensions of supply have been realised since that date, so that plant extensions cannot long be deferred. The unexpected growth of the undertaking has already filled the original engine room (40 ft. × 29 ft.), and further extensions will necessitate the erection of additional buildings, for which there is ample ground available, (see fig. 1). The engine room will probably be extended towards the canal, good foundations being available, without pile driving, at a depth of 4 or 5 ft. A 500-kw. turbo-unit will probably be adopted as the next extension set, though Diesel engine developments are being closely watched with a view to avoiding, if possible, the capital outlay required by additional boiler equipment. Despite careful lagging, there is considerable condensation loss in the present long lengths of steam piping traversing exposed spaces between the destructor and boiler house and the engine room.

During the year ending March 31st, 1911, 363,756 units were generated; the total connections amounted to about 380 kw., and the maximum demand recorded at the works was 280 kw.

Street lighting accounts for one-fourth of the total sales; and the cost of this service averages 2·91d. per unit, including repairs and switching, or 2·30d. per unit including only capital and energy costs. Four 3-ampere and twelve 5-ampere J. & P. enclosed arcs have been in use for some



b b, Lancashire boilers; B, battery room; C, coal store; D, destructor; E, engine room; Ex, space for extensions; H, destructor hopper; O, offices; P, pump room; S, smoke stack; W, water softener; Wh, coaling wharf.

Fig. 1.

time, and to these have lately been added six British Westinghouse magazine flame arcs. The remainder of the nine miles of streets are electrically lighted, chiefly by Holophane prismatic globes containing pairs of 16 c.p. or 25 c.p. 220 v. Sunbeam "tubular" lamps.

The latter have cylindrical bulbs with side pips, and contain two U-loops of carbon-filament—the longer one supported by a horizontal bracket and loop, the other hanging freely from its ends. The reasons for the present adherence to these carbon lamps (of which 50 of 50 c.p. and 183 of 32 c.p. are now in use) are:—(1) The excellent lighting obtained. A pair of 16-c.p. tubular lamps in a

prismatic globe are equivalent to two 32 or 50-c.p. "pear" lamps in a clear lantern. (2) After 3,000 hours in service, these lamps show remarkably little blackening, and a service life of 6,000 hours is not unusual. (3) No metallic lamps are yet available which will properly utilise the existing glassware.

Separate three-wire cables (220-440 volts) supply the street lamps. The lamps in each lantern are across opposite sides of the supply mains, and at 11 p.m., one lamp on each standard, and half on each side of the three-wire net-

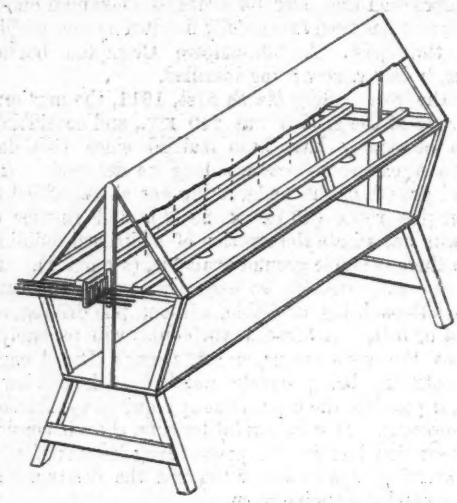


Fig. 2.—Showing Lamp Battens on Stall.

work, are switched off from six control points (about 40 lamps per point). The remaining lamps burn till dawn. Each switching "round" occupies one man for about 40 minutes.

Public houses and places of amusement account for a large total load. Four "picture palaces," now in operation, each average 15-20 amperes demand at 440 volts (motor-generators being in use near the lanterns). This demand, being practically constant between 7 and 11 p.m. nightly, is most valuable in flattening the evening peak (the summit of which is reached at about 8 p.m.). Shop lighting constitutes the major portion of the "private" load. Only about 40 residences are supplied; these require about 2 miles of special distributing mains, and do not form a profitable load. Throughout the system, shop and street lamps are supplied by independent cables.

The metallic-filament lamp "crisis" was never severe in this area, and its effect is now more than compensated by the increased number of lamps connected. There is here no prospect of important electric heating and cooking developments, and the present motor load is insignificant, totalling only 60 h.p. for the whole supply area.

A most interesting system of market lighting is in vogue on the open-air market stalls. Prior to the introduction of the present equipment, some four years ago, paraffin flares were used for lighting the stalls. Eightpence per lamp per night was charged for hire and paraffin, but so objectionable and dangerous were the lamps that the proposal to provide two 25-c.p. tantalum lamps at 6d. or 4d. each per evening (Saturday and Monday markets respectively), and additional lamps at 3d. or 2d. each, received instant approval.

TABLE I.—Typical Demand in Mexborough Market Lighting Scheme.

Side of three-wire system.	Number of stalls requiring— Two lamps.	Four lamps.	Six lamps.	Eight lamps.	Total 25-c.p. tantalum lamps.
Positive ...	14	12	3	2	110
Negative ...	16	11	2	1	96
Total on 61 stalls ...	...	...	...	...	206

A three-wire feeder is run from the supply station to distributing boards placed in an archway beneath the Market Hall (fig. 3). Thence eight overhead rubber-insulated cables (four per side of the three-wire system), are run, on market evenings, through reel brackets placed on the stalls (fig. 2) to 2 in. × 2 in. wood battens supported between the end frames of the stalls as shown. These battens are permanently cabled with cased-in wires and fitted with bayonet lamp-holders and white enamelled reflectors. One or two battens per stall and two, four, six or eight lamps per batten are provided according to the requirements of the stall holder (see Table I); 110-volt tantalum lamps are run two in series. A fuse box is provided in each row of stalls, and adjacent rows are connected to different service branches, so that, in case of a fuse blowing, the stalls affected are sufficiently lighted from neighbouring rows. Connection between battens placed end to end in a row of stalls is effected by lengths of cable with adaptors fitting into the end lampholders of the battens.

So far, only trivial repairs have been required in the distributing leads (which are stored on drums when not in use), and lamp breakages, with an average of 200 lamps in use, average two per week. Two men can erect or dismantle the whole temporary equipment in one hour, and an assistant is always in attendance at the distributing boards to replace lamps, fuses, &c. The convenience and hygienic value of the electrical system cannot be exaggerated, and a simpler and more effective system could hardly be desired. The lamp-hiring fees are collected with the stall rents.

The Market Hall is well lighted by groups of three Osram lamps in reflector lanterns, and stall holders are provided with 55-watt lamps at 4d. per evening.

Considering the small output of the station and the poor day load at present available, the generating costs are exceptionally low at Mexborough, and the financial position of the undertaking is very satisfactory. The costs of production per unit for the year ending March 31st, 1911, amounted to 0·76d. per unit, and the total costs to 1·37d.

Prepayment meters are employed in a few cases, but the standard flat rate for lighting supply is 4d. per unit to houses and shops alike, with a sliding scale of discounts to large consumers.

A flat rate of 3d. per unit, with discounts, will probably be made in the near future. Supply for power purposes is at from 2·5d. to 1d. (net) per unit, according to the total consumption. The average revenue per unit sold being 3·10d., a balance of 1·73d. per unit was carried to net revenue account in 1910-11, as against 1·62d. in 1909-10

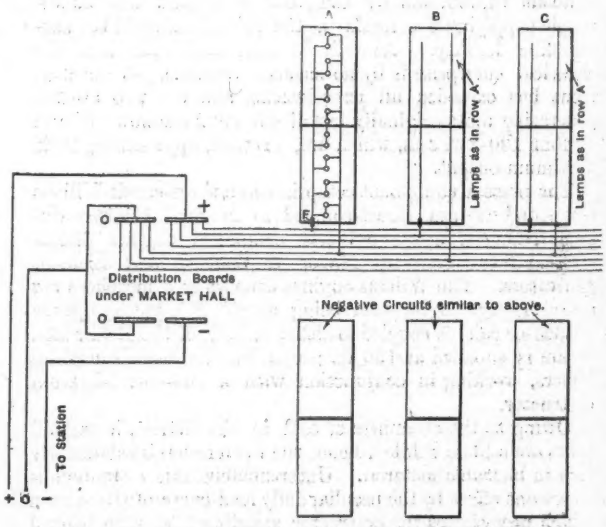


Fig. 3.—Arrangement of Wiring, Mexborough Market.

Consistent endeavours have been made to curtail capital expenditure, and, of the £23,900 of loans sanctioned to date (£59·75 per kw. on the present station capacity), £1,644 remains unexpended and £6,619 has been repaid. The undertaking realised 10 per cent. gross, and 2·5 per cent. net profit during 1910-11, and is fortunate in having accumulated a handsome depreciation and renewals fund.

In this small community, the "satisfied consumer" is an invaluable asset to the supply station. The whole of the street lighting is already in the hands of the electricity department, and there is every prospect of continued rapid development of private supply.

Within the last 12 months the Mexborough and Swinton Councils have acquired joint ownership of the hitherto company-owned gas works supplying the two areas. This

change is not likely to affect the electricity department otherwise than by restricting the capital available for its extension, and by postponing for a time the realisation of a scheme of "unlimited use" contracts for four-light cottage supply, which had been drafted.

There is an admirable field for trolley-'buses in the Mexborough district, and it is very probable that these will be adopted in the near future. The efficiency of the station would then be greatly improved by the advent of an important day load. Could a joint board be arranged to supply electrical energy from the Mexborough station to the neighbouring Wath and Swinton areas, and to run a trolley-'bus service over the Mexborough, Bolton, Goldthorpe, Wath and Swinton districts, residents in the latter would be rendered a service no less than the economic advantage accruing to the administrative authorities concerned.

In concluding these notes, we must express our indebtedness to Mr. J. Senior, the resident electrical engineer, for his courtesy and assistance in explaining the conditions and working of his undertaking.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

An Association called the Ontario Municipal Electric Association has recently been formed, and it is intended that the various municipalities represented by it, which all take current from the Hydro-Electric Power Commission of Ontario, shall act in concert and assist the Commission in furthering all matters connected with the development of water-powers, and the use of electricity generated thereby, throughout the Province. As Ontario is one and one-fifth times the area of the British Isles and she possesses abundant water-powers, it will be seen that there is plenty of scope for the efforts of the Commission and of the municipalities referred to.

A recent report on the natural resources of Northern Ontario states that there are 20 million acres of good agricultural land to be settled in that part of the province. Besides this there are extensive mining regions which are steadily advancing in importance.

The geological survey branch of the Department of Mines, in one of its reports, gives some interesting details as to the mineral wealth of Canada.

The coal supply of Nova Scotia has been estimated at 6,000 million tons.

Iron is found in most parts of the country, but it is not yet mined on a very large scale; notable expansion is expected.

Gold is mined in British Columbia, the Yukon, Ontario, Nova Scotia and Quebec.

Silver is found in abundance in Northern Ontario and in British Columbia, and it is said that the silver districts of Cobalt and the Montreal River occupy the premier position in the world.

Lead, though mined only in British Columbia, occurs in other provinces.

Copper is found in British Columbia, Ontario, and Quebec.

Nickel is said to be one of the most important metallic products of the Dominion.

Manganese, mercury, platinum, tin, arsenic, antimony, and graphite, are all to be found in various parts; while asbestos, gypsum, mica, and corundum, are extensively mined at the present time. Asbestos is the chief mining product of Quebec, the deposits in that province being the most important in the world.

The foregoing minerals will be mined in increasing quantities as time goes on, and as the population of the country increases, and will add enormously to the wealth of Canada. Though the information given is not of direct interest to electrical engineers, it will serve to give some slight idea of the wonderful possibilities of this vast section of the British Empire—incidentally there should be some interest in the fact that coal and other mines are sure to use electrical appliances to an increasing extent every year.

As a Britisher in Canada your correspondent was very interested in the recent article on "Colonial References," dealing with conditions in South Africa. Conditions over here are somewhat different from those prevailing in that country, and though it may be doubtful whether a man returning home after good experience here would have much chance of finding suitable employment, there is no doubt that a good man with a few years of Canadian experience behind him would be worth his weight in gold to any firm determined to work up a business connection here, as he would be able to advise them on subjects, and in ways, in which home engineers are, necessarily, entirely ignorant. Any good British firm, acting under the advice of such a man and having a capable representative in this country, should be able to do a profitable business.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Fraudulent Tests.

I have read with considerable amusement the protest of "Modulus" against the article on "Fraudulent Tests" in your issues of the 5th and 12th inst. If ever there was a case of a "forlorn hope," it is that of your correspondent to uphold the sanctity, the respectability—I nearly said the honour—of some of our British manufacturers.

With "Modulus," I can claim 15 years' experience in test rooms of some of the foremost manufacturers of the day, and, absurd as it is, among the most reputable. In addition, I have represented consulting engineers for official tests in some of the leading works. The only difference between my own experience and that of the contributor of the article is, that the tests that I have carried out for manufacturers, and witnessed for consultants, have been purely electrical. I can fully endorse the conclusions of the writer of the article that most official tests are "faked."

"Modulus" says that he would not "dare have the effrontery to attempt to befool by most of the obviously crude and certain-to-be-found-out so-called tricks of the test bed" mentioned by the writer of the article. Um! he's not much use in a test room, then, that's all.

The experience of "Modulus" as to Admiralty overseers is 14 years of his life wasted. What will he say when I tell him that I have pushed a universal galvanometer shunt over by one stop to get a test passed, and that directly under the nose of the overseer?

Such practices may be "bad policy." That is not the point; they are adopted. The methods may be "insane," but they are adopted, and the firms adopting them pay dividends.

It is useless for "Modulus" to grumble that the conclusions of the article are not that "All men are Liars," but liars all the time. He must face facts. Test-room men *are* all liars, and liars all the time, and then some—as the Americans have it—where official tests are concerned.

I can assure "Modulus" that some of the amusement of the test man's life is the tricking of inspecting engineers. Just as some men find pleasure in risking their necks in riding dangerous horses, driving cars over dangerous places, or dare-devil feats in aeroplanes, so the test man gets his fun in skimming as near as he can on "official tests." Bah! they are not worth the paper they are written on.

I could multiply up cases in which I have participated *ad nauseam*, could any good come of it. It is useless. It was ever thus, and thus in these commercial days it will ever be.

The denial of "Modulus" that falsified instruments exist is piffle. The fact that he cannot conceive "that any sane engineer would attempt such impossible methods" merely argues lack of knowledge. Such "impossible" methods are used—and succeed. Finally, if "Modulus" will detach himself from his exalted rank in a works and

carry out an official test he will soon be initiated into the mysteries of these plausible fakes or—lose his job.

As a certain amount of my bread and butter comes from my being "a liar," and "a liar all the time," I must ask you to withhold my name, and, although a liar has for once spoken the truth, will subscribe myself

Pluto.

"Modulus" has already replied to the article under the above title, and doubtless those in authority in the testing departments of responsible firms could give even more complete replies. I only wish to refer to one or two minor points. I had the honour of spending some time in the testing department of a large electrical engineering firm, and so the statement that "any experienced tester could add to the list," appeals to me. During my time I worked on many official tests, and a variety of fakes were certainly adopted, but nearly all in order to shorten the time of test, and to avoid overtime, very few indeed to pass a bad machine. The only fault that I, as a tester, had to find with an official inspector, was that he arrived late in the morning, and then wanted a day's work done, thus keeping the tester—usually a college man unused to early rising—up late with the prospect of rising early next day; and also completely upsetting his social arrangements. Under such circumstances, it was natural that all possible should be done to complete the test without delay, with no desire to hustle the inspector into passing a bad machine. It should be remembered that all machines for official tests are tested beforehand, and all faults rectified in anticipation of a strict inspector. This is as great a safeguard as the subsequent "on site" test.

Personally, I would absolve the firm from all responsibility for test-bed fakes. I never received, nor ever heard of any of my colleagues receiving instructions to falsify tests; and certainly no "adjusted" instruments were ever employed.

I do not intend to add to the list of means of falsification—I do not wish to destroy the innocence of the tester of the present day—nor do I intend to refer in detail to the means suggested. Just three of these I would criticise. The first is the removal of load while the inspector is at lunch. This is an obvious method, but if a curve be taken of the temperature of the stationary parts—stator or series field windings—such an action is easily detected. This curve should certainly always be taken. Then the temperature rise should always be checked by taking hot and cold resistances, and calculating increase of temperature from the known temperature coefficient. This is a far more reliable check than might be imagined.

The use of a second rheostat in series with the field is new to me, but it would be easily checked by a reading of the field current. In every regulation test I ever did, whether official or otherwise, the field current was taken, as well as the line volts, and any variation in the resistance of the field circuit would be easily detected.

R. S. T. V.

London, S.W., *April 22nd*, 1912.

The New Articles of the I.E.E.

Among the recent proposals of the Council for the amendment of the Articles of Association of the Institution of Electrical Engineers, those for the modification of the conditions of membership and the formation of the new class of Licentiates encountered very determined opposition. The proposals in question seem to be held, at the present moment, in abeyance, presumably while the Council examines the matter further. If this be so, then I would suggest that the suggested alterations of the constitution of the American Institute of Electrical Engineers, which are put forward by the governing body of that society be taken into serious consideration by our Council, as I am of the opinion that the alterations proposed by the American Institute, while attaining a similar end to the Institution's suggestions, are not open to the same objections as are these.

The opinion has been expressed by many that the above-mentioned proposed alterations of the conditions of membership of our Institution will result in a levelling down of the status given by membership. The American proposals, on the other hand, are certainly of the nature of a levelling up. They consist, in short, of the formation of a new class at the top—viz., higher than the grade of "Member" and designated "Fellow." To this class engineers only will be admitted who possess certain stringent qualifications. Below this will come the class of full member and the associate.

I will not take up your space to point out the advantages of this scheme as compared with our own, but respectfully submit the same to the decision of the Council of the Institution.

Charles C. Garrard.

Sutton Coldfield, *April 17th*, 1912.

Review of "Electric Mains."

It is generally inadvisable for an author to comment on an unfavourable review, but I think this rule may be safely broken in face of the extraordinary attack made by your reviewer, in the issue on April 12th, on the publishers of "Electric mains and distributing systems" (The *Electrician* Publishing Co., Ltd.)

First of all he should not have forgotten that, by the courtesy of the publishers, one of the earliest copies was placed at his disposal. No list of errata had then been inserted, but this was done very shortly afterwards. This list contained practically all the instances of error mentioned by your reviewer.

The authors do not agree that uniformity of symbols is at all necessary in a book of this kind. The diagrams are so simple that it is preferable for the reader to turn to them from the adjoining text, instead of trying to remember pre-arranged symbols.

It is a little amusing to note that in the solitary algebraical expression which the reviewer himself employs, the setting up is not beyond reproach.

The redundant and omitted words referred to must depend on ideas of style of which the reviewer alone possesses the secret. To suggest that the book is practically useless because of lightly printed fraction lines and sundry printer's errors, obvious to a first year student of algebra, is to make a statement which stultifies itself by its wild extravagance. It would be pleasant to return the compliment, the authors were paid on their "fearless and straightforward" criticisms, but the reviewer's statements on the get-up of the book cannot unfortunately be described in such gentle and innocuous terms.

J. R. Dick.

Reading, *April 22nd*, 1912.

Anticipating that the authors would not be delighted with my review of "Dick and Fernie," I endeavoured to express therein, as clearly as possible, my disappointment at having to write as I did about it. I will deal with Mr. Dick's letter as briefly as possible.

Every reviewer is aware that the volume he receives is an early copy, but I consider that the length of time that elapsed between the first publication of the articles in the *Electrician* and the appearance of the book was quite sufficient to allow of the removal of all serious defects.

Perhaps uniformity of symbols is not exactly necessary, but that it is desirable, I think, no one will deny. Do we not have an international committee to provide uniformity? Why, then, should Mr. Dick object to keeping to one set of symbols? Surely it would be easier for himself.

Mr. Dick is welcome to the "little amusement" (precious little, I should think) that he gets out of the setting up of the algebraical expression referred to. Your setting is at least not incorrect, and the idea of comparing a text-book, produced very much at leisure, with a weekly journal produced under pressure of time, is remotely verging upon the extreme confines of coolness.

Mr. Dick's comments on the reviewer's "secrets of style" are not for me to answer.

He is scarcely complimentary to his colleague and himself when he suggests that "errors obvious to a first-year student of algebra" were passed in the proofs. I have yet to meet, however, the first-year student of algebra who deals with the putting of differentiated expressions equal to zero.

I cannot see that Mr. Dick has made out any case for departing from the excellent rule which he mentions in his first sentence. If he is satisfied with the get-up of the work, I suppose it is no business of mine to grumble, but I can only say that I should never have allowed any work of mine to reach a reviewer's hands in the state in which this reached mine.

I gave my considered opinion on the book as a literary and as an engineering work, and I have nothing to add to it, and nothing to withdraw from it. I am not concerned with whether or not it is agreeable, either to the authors, or to the publishers whom Mr. Dick seems to be so anxious to defend.

Your Reviewer.

Electricity Direct from the Coal Mine.

In your issue of the 12th inst., there is an editorial discussing Sir W. Ramsay's suggestion as to producing gas direct from the coal mine without hewing the coal. The difficulties connected with this method of working are very correctly pointed out, and you propose that these difficulties might be overcome by hewing the coal and converting it into gas at the base of the shaft, from which point the gas would be brought to surface and there used to generate electricity.

I have delayed suggesting another alternative feeling sure that it would be made by others and appear in your issue of the 19th inst. I have had it many years in mind, as doubtless have other engineers, but I do not remember having seen it published.

My proposition is that the coal should be used at the base of the up-cast shaft to work a steam operated power plant there situated, from which point electricity could be easily and conveniently transmitted.

The up-cast shaft would be used as a smoke flue for the boilers; how far this would serve as an automatic ventilator for the whole mine would depend upon circumstances, but the practice of ventilation by means of fire at the base of the up-cast shaft is old and well known, whilst the draught could be increased if necessary by an air propeller, as is common in modern boiler houses.

In your issue of the 19th inst., you state various reasons why gas engines have been less successful than steam engines in this country; it is unnecessary, therefore, for me to reiterate these in support of my proposition. Either alternative saves the cost of bringing the coal to bank, but my scheme *inter alia* obviates using much of the valuable shaft area which gas pipes would occupy.

I venture to suggest to the engineers of the different Kent coal companies, that the comparative proximity of their mines to London renders this proposition particularly worthy of their full consideration.

W. Geipel.

London, S.E., *April 22nd*, 1912.

Midland Electrical Exhibition.

With reference to the above Exhibition which it was proposed to hold at the Bingley Hall, Birmingham, from October 7th to 26th, I regret to inform you that the British Electrical and Allied Manufacturers' Association has declined to allow its members to take space at this Exhibition. They suggest an alternative by which the whole cost and hazard of the Exhibition would be thrown upon the shoulders of the local authorities, whilst the manufacturers, whose goods would be exhibited and sold at the Exhibition, would pay nothing whatever beyond a trifling contribution towards the general expenses; this alternative the Executive Committee are unable to accept.

They consider that, as any benefit which would result from the Exhibition would be first felt by the manufacturers whose goods are shown, these manufacturers should at least be prepared to bear a fair share of the cost. Moreover, a much larger proportion of the profit derived from an increase in business would be obtained by the manufacturers than by the local authorities and companies who provide electrical energy. When it is remembered that before any electrical energy can be employed, plant must be purchased for its generation, mains laid for its distribution and electrical machinery for its employment purchased, it will be obvious to everyone that the expenditure which passes into the pockets of the manufacturers is much more substantial than that obtained by the undertakers, who are selling the current.

The promoters of the Exhibition deplore the attitude which the Manufacturers' Association has taken up; they consider that a valuable opportunity for demonstrating to the manufacturers and residents of one of the richest and most prosperous industrial districts in the country the superior advantages to be derived by the employment of electricity has been lost.

They have had so many private assurances from members of the Association that they are confident that, had the Manufacturers' Association left their members free to take space upon the terms usual under such circumstances, a splendid and representative Exhibition would have been obtained.

The Council of the B.E.A.M.A. includes representatives of firms who manufacture steam plant and large generating plant, to whom an Exhibition of the kind proposed does not appeal, and apparently their influence has been thrown in the scale against the desires of those manufacturers who would benefit, with the result that a grave error of judgment has been committed. This is additionally unfortunate, as, in view of the recent conditions in the neighbourhood of Birmingham arising out of, and in consequence of, the coal strike, the opportunities of introducing and pushing the employment of electrical apparatus are unusually favourable, and with reasonable courage and enterprise on the part of the manufacturers, a substantial increase in their employment could have been secured.

Howard Foulds,
Hon. Sec., the Midland Electrical Exhibition Executive Committee.

Birmingham, *April 23rd*, 1912.

Architects and Engineers.

I suppose the Association of Consulting Engineers is dead, or was it stillborn? But if Mr. James Swinburne and his young men are still alive, cannot they turn their attention to the poaching that goes on by architects who build hospitals, large asylums and other institutions?

The amount of pure engineering work, besides electric lighting, which is in the hands of plumbers and hot-water "engineers"—each architect having usually his pet firm—is very large, though but a small percentage of the total upon which the architects charge their commission; and, in cases where an engineer is called in to advise, the commission on the engineering work, or a portion of it, has to be shared.

If an engineer attempts to build a bridge, without calling in an architect, what a row is kicked up in and out of Parliament; and why should not the Association of Consulting Engineers, if it exists, try to be useful?

Fair Play.

London, *April 20th*, 1912.

Public Clocks for Southport.—After exhaustive trials of several systems of electric clocks extending over the last 12 months, the Corporation of Southport has now announced its decision regarding the proposed municipal time service for the borough. It has adopted the "Synchronome" method of electrical impulse dials, of which, to begin with, 15 will be erected for the most part on trolley posts and arc lamp standards at points widely distributed throughout the town. The controlling pendulum will be placed in the chief office of the Borough electricity and tramway engineer, connection to the dials in single series circuit being by means of upwards of seven miles of wire, most of which is underground. Where overhead line is used, special precautions are being taken to avoid an interruption of the service in the event of breakdown. The dials are of high temperature enamelled metal, with movements and hands totally enclosed in hermetically-sealed weatherproof cases of the same material. The installation is fundamentally a duplicate of that at Marble Arch, but carried out on a much larger scale, by the Synchronome Co., of Clerkenwell, and capable of indefinite extension.

THE LAKE COLERIDGE POWER PLANT, N.Z.

Work has recently been commenced on the first of the hydro-electric power schemes of the New Zealand Government to be put in hand under the Water Power Act of 1903. The provisions of this Act vest the right to all water power within the Dominion

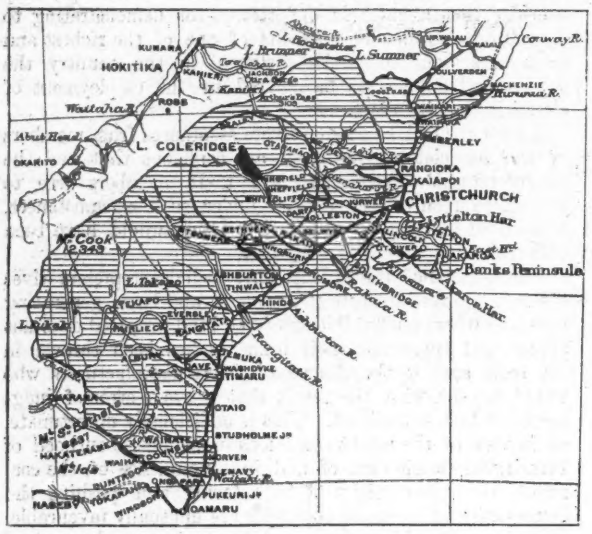


Fig. 1.—The Lake Coleridge (N.Z.) Electric Supply Area.

of New Zealand in the Government, and confer on the Minister of Public Works the necessary powers to construct and operate hydro-electric installations.

A report was obtained in 1904 from Mr. L. M. Hancock, of the California Gas and Electric Corporation dealing with the subject

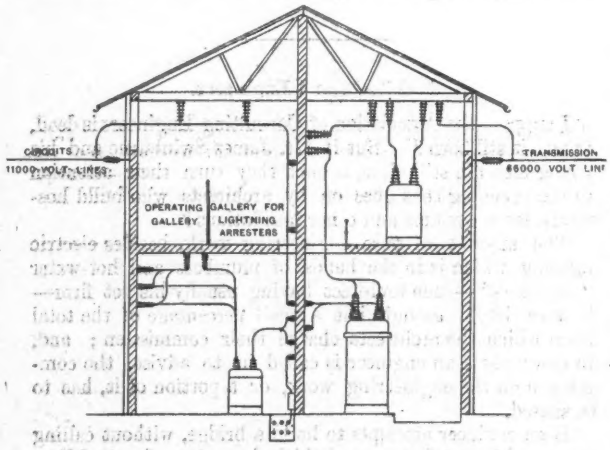


Fig. 2.—Proposed Sub-Station Arrangement.

in a comprehensive manner. The Public Works Department, at the same time, investigated all the available sources of power within the Dominion, gauged the rivers and instituted a system of recording the rainfall and the flow of the most important rivers. A full report was prepared by the late Engineer-in-Chief, Mr. P. S. Hay, dealing exhaustively with the available sources of power, which has formed the basis of all subsequent investigations on the subject.

After considerable discussion the Government decided to carry out the development works themselves in preference to leasing them, and the "Aid to Water Power Act" of 1910 authorised the Government to raise loans not exceeding £500,000 per year for five years for this purpose. A special branch of the public works department was established to carry out the work and was placed under the charge of Mr. E. Parry, assisted by Mr. L. Birks.

The first scheme to be put in hand is the Lake Coleridge installation for the supply of Christchurch and the Canterbury Province. The head-works for this development are now in hand, and specifications have been prepared and tenders invited for the necessary plant and equipment.

The approximate area of supply is shown in fig. 1.

Lake Coleridge is situated in the Southern Alps, about 70 miles to the west of Christchurch. Its surface is 1,667 ft. above sea level; it is 10 miles long and 2½ miles wide, with an area of 14 sq. miles. In spite of its altitude the lake does not freeze, and its shores are entirely free from driftwood or other refuse. The outlet of the lake is at the western end, where the waters discharged from the lake and the Harper and Wilberforce Rivers unite to join the Rakaia River further down. The latter river flows eastward parallel to the lake shore, and separated from it by a ridge ranging from 1½ to 2½ miles wide, consisting of soft shale covered with glacial drift in a matrix of clay. The river beds have an average fall of 30 ft. to the mile, and a length from the lake outlet to a point in the Rakaia opposite the eastern end of the lake is 16 miles. The gross head available at this point by piercing the separating ridge is 494 ft., the flood level in the Rakaia River being 1,173 ft. above sea level.

The lake is fed by four streams, and owing to the enormous storage area the flow in the stream is very steady.

The power available from the present outflow of the lake is thus 5,000 KW. for continuous working, or 10,000 KW. on a 50 per cent. load factor. This is ample for the present purposes, but for future developments it can be increased indefinitely.

The ultimate capacity of the development can be increased as required to 50,000 KW. for continuous operation or double this amount on a 50 per cent. load factor.

The water will be conveyed from the lake to the river bank by a tunnel 110 chains long, the maximum flow provided for being 270 cb. ft. per second. In order to provide for future developments, the crown of the tunnel at the inlet will be 12 ft. below lake level, the tunnel being worked under this pressure. The entrance to the tunnel will be provided with duplicate gates and screening chambers so designed that the screens will be accessible at any time without cutting off the supply, and that the pressure on the gates can be equalised before raising. The tunnel is provided at the outlet end with a surge chamber 30 ft. square, and with gates and screenes operated on the same principle as at the inlet. This arrangement entirely dispenses with costly mechanism, and yet gives complete control of the flow in the tunnel. The surge chamber is designed in conjunction with the governors, fly-wheels and reactances of the generating sets so as to minimise, as far as possible, the disturbances arising from changes in the load, and to enable the output to respond automatically to the requirements of the service.

A vertical shaft midway along the tunnel will also serve as an additional surge chamber to assist in taking up the fluctuations of energy and adjusting the velocity of the water in the tunnel more rapidly to the exigencies of the service.

Provision is made in the power house for an ultimate equipment of six main generating units of 1,500-KW. capacity each, and two hydraulically-driven and one motor-driven exciter unit of 150-KW. capacity. These will be supplied from the surge chamber by three penstocks half a mile long; each main penstock will branch at the lower end supplying two turbines.

The pipes will mostly be laid underground with a cover of earth, and to prevent corrosion will be coated inside and outside with a high quality of bitumen compound, the outer surface being further protected with a serving of Hessian laid on while the bitumen coating is still soft. The exciters will be supplied from a 15 in. bus pipe, which will connect the three main penstocks at the lower end. In order to further equalise the flow in the main penstocks they will be connected in ordinary operation at their lower end by means of this bus pipe.

The main turbines will be of the Francis reaction type, of 2,150 B.H.P. normal output and 2,700 B.H.P. overload capacity, and the exciter wheels will be of the Pelton type, of 225 B.H.P. normal output and 270 B.H.P. overload capacity.

The main generators will be three-phase alternators of 1,500 KW. normal capacity at a pressure of 6,600 volts and 50 cycles. The exciters will be 150 KW. 110-volt direct-current generators. The motor for the motor-driven exciter will be of the synchronous type motor operated direct from the 6,600 volt bus-bars. In addition to the exciter generators a battery of 56 cells, each of 800 ampere hours capacity, will be installed to ensure a supply of energy for excitation under any emergency which may arise.

The present installation will include two penstock pipes, three of the main generating units and one hydraulically-driven exciter.

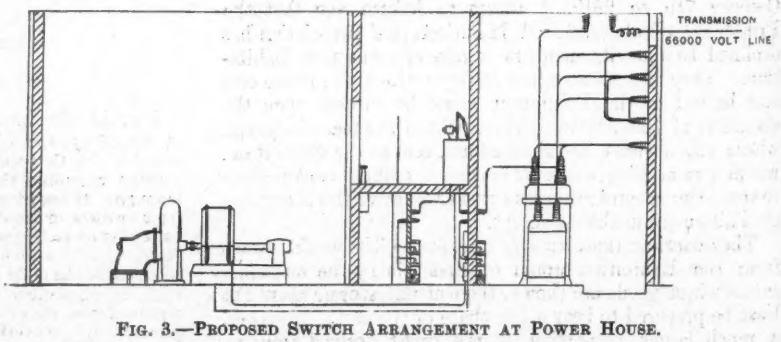


Fig. 3.—Proposed Switch Arrangement at Power House.

The ultimate output of the complete plant of six units is based on the capacity of five units at rated load or four units at 25 per cent. overload, that is, a maximum of 7,500 KW.

The output of the station will be controlled by a switchboard consisting of six main generator panels, two main transformer and

feeder panels, two synchronous motor panels, and one centre synchronising and inter-connecting panel.

All switches will be of the remote-controlled oil-filled type placed in a gallery behind the switchboard, and provision is made by means of interconnecting switches for dividing the whole installation electrically into two independent systems, each supplying one of the duplicate banks of main transformers and transmission lines, thus reducing the risk of stoppage to a minimum.

The exciter switchboard will be mounted with separate exciting and power house supply bus-bars with double-throw exciter generator and battery switches, thus allowing the exciting voltage to be regulated by means of a Tirrill regulator, so as to compensate for the ohmic and reactive drop in the transmission line, and ensure a steady pressure at the main sub-station.

The step-up transformers will consist of two banks, each of three 1,500-KW. single-phase oil and water-cooled transformers, raising the pressure from 6,600 to 66,000 volts for transmission.

The transmission lines from the power station to the the main sub-station at Christchurch, a distance of 70 miles, will consist of two independent pole lines, each carrying three conductors, consisting either of 7/12 S.W.G. copper or 7/135 aluminium cables carried on four shell-pin insulators, and spaced triangularly 6 ft. apart.

At the Christchurch sub-station the pressure will be reduced by two banks of step-down transformers identical with the step-up transformers, but star connected on their secondary side to give 11,000 volts three-phase for the primary distribution. A branch of the 66,000-volt transmission line will also be run to Timaru—a flourishing seaport 100 miles south of Christchurch—and ultimately in a northern direction also, with sub-stations at intervals transforming down to 11,000 volts, at which pressure the energy will be distributed throughout the province. The energy will be supplied in bulk by means of underground cables to the Christchurch Tramway Board and the Christchurch City Council for retail distribution. It will also be distributed by means of overhead cables to the suburban boroughs and country towns, large meat works, woollen mills and other industries in the district as required.

It is estimated that a capital expenditure of about £375,000 will be required to install the full 9,000-KW. plant with distributing mains to all the main centres of population in the province. But only three out of the six units are included in the present installation.

The estimates indicate that power will be available at £6 10s. per H.P. per annum at the consumers' terminals.

Arrangements are being made for converting the portion of the railway between Lyttleton and Christchurch to electric working, the determining factor being the difficulty of ventilating the Lyttleton tunnel, and it is confidently anticipated that after gaining the experience of electric working on this section, it will be extended to the main lines.

A supply will also be required for the electric haulage through Arthur's Pass Tunnel, now in course of construction. This tunnel, which will be five miles long, forms the connecting link of the Christchurch-Greymouth line, between the east and west coasts of the South Island. With two tunnel sections operated electrically, it is probable that the remainder of the line will be converted in the early future.

A large and comprehensive scheme is now under consideration for the supply of electrical energy in the North Island with the object of making it generally available to all the towns and districts throughout the Island, and it is anticipated that advantage will be taken of the facilities offered to work the railways by electricity and to promote a system of light railways throughout the country districts now suffering from lack of communication because of the difficulty of obtaining stone for surfacing the roads.

Foreign Languages for Commercial Men.—About 18 months ago an Association was formed, called the "Institute of Linguists," for the purpose of promoting greater interest in the study of foreign languages—more especially in regard to commercial men. The Council of the Institute is strong and representative, including the French, Russian and Spanish Ambassadors, the Earl of Denbigh, Mr. Francis Storr (Editor of the *Journal of Education*), Sir Gilbert Parket, M.P., Mr. E. C. Jerningham, Sir James Yoxall, M.A., Sir Henry Wood, M.A., and other persons well-known in the literary and commercial world. A number of examinations have been held, and the next, which is fixed for August 2nd and 3rd, 1912, will be, as heretofore, under the direction of the University of London. This examination is open to both men and women, is divided into two sections, commercial and literary, and sets up a high standard of proficiency.

It is the aim of the Institute to convert the heads of business firms to the idea that all their clerks ought to be efficient linguists, and that they should demand that every candidate for a position in their business should be able to produce a certificate of proficiency. If this were generally done, England would soon be placed on an equality with other countries on this important point, the ability to speak other languages besides one's own.

The Council has already been able to supply large business houses with efficient foreign correspondents, and hopes shortly to establish an employment bureau; and it is desirous of building a properly-equipped institute in London, and establishing a correspondence course in connection with it. All this requires money, and an appeal is being made to the public for support. The hon. treasurer, Mr. W. Lacon Threlford, will be glad to answer any inquiries and accept monetary assistance at 120, London Wall, London, E.C., the headquarters of the Institute (*pro, tem.*).

PARLIAMENTARY.

Birmingham Corporation Tramways.

On April 16th, a Select Committee of the House of Commons, presided over by Sir E. A. Cornwall, commenced the consideration of the Bill of the Birmingham Corporation, which provides for considerable extensions of the tramway system.

Mr. Balfour Browne, K.C., Mr. H. Lloyd, K.C., and Mr. Jeeves appeared for the Corporation; Mr. C. C. Hutchinson, K.C., and Mr. H. H. Joy represented frontagers and property owners in Edgbaston and Harborne; Mr. G. J. Talbot, K.C., Mr. L. Maccassey, and Mr. A. Mains were for the London and North-Western Railway Co., and there were other petitioners not represented by counsel.

Mr. Lloyd, K.C., opened the case, and said that both in 1901 and 1907 the Corporation promoted tramways for Harborne and failed. The proposal now was to construct a tramway along the Hagley Road to Harborne. This was a different route from that proposed before. It was a road along which there was a great deal of traffic, and a five minutes' service of three-horse omnibuses. At present people could get to the city by train, but the service was not frequent and was unpunctual. There was a distinct demand for tramways along the route, and there could be no doubt it would be a financial success. Fifty years ago Harborne was a quiet rural district, but there was now a population of 14,000, and it was increasing rapidly. With regard to Edgbaston, the question to consider was whether the ultimate good of the whole district did not require that tramways should be constructed.

Mr. Alderman Beale, chairman of the Works Sub-Committee of the Tramways Committee, gave evidence as to the proposed Harborne route, and said the Corporation had for several years had pressure put on them to make a tramway along the Hagley Road. He did not think the road would be depreciated by the tramways, and it was a very noisy road now.

In cross-examination, Witness said the situation had altered considerably since 1907 by the annexation of Quinton, which was undeveloped. The question must arise whether the tramways should go there and create development, or whether it should wait until there was a development for tramways. His opinion was that they would have to develop Quinton by a possibly unremunerative tramway.

Answering the Chairman, Witness said that the Town Planning Committee and the Tramways Committee were working together with regard to the tramway scheme.

Mr. Alfred Baker, general manager of the Corporation tramways, said the length of the system at present was 102 miles, and there were 460 electric cars in daily service. The capital invested represented nearly £2,000,000. Last year 85 million passengers were carried. As, however, two further important lines were taken over by the Corporation in June last, it was probable that during the current year 135,000,000 passengers would be carried. The fares in Birmingham were probably cheaper than in any other town in the United Kingdom, the average being 2½ miles for a 1d. After paying expenses and setting aside a considerable amount for reserve contingencies and depreciation, the Tramways Committee paid over £41,103 last year in relief of rates. He considered the Hagley Road an ideal one for tramways, and believed no loss would result from the working of the proposed tramway. He estimated that the Hagley Road route would produce a revenue of £9,247 a mile, and it would be a considerable relief to the Dudley Road tramways. The Harborne route would not be so valuable, but he thought the traffic carried would be sufficient to make it pay and leave a surplus.

Answering a member of the Committee, Witness said he did not think motor 'buses would live side by side with tramways in Birmingham, for the tramway fares were very much cheaper than the motor 'buses could adopt on account of their heavier expenses.

Replying to the Chairman, Witness said he did not believe the opposition to the tramways came from Harborne at all, but from the people at Edgbaston, who did not want the tramways to go through their district. They could not go to Harborne without going through Edgbaston.

A number of witnesses were called, resident in the districts proposed to be served, in favour of the scheme.

Mr. H. E. Stilgoe, the city surveyor, who had prepared the estimates and plans for the proposed tramways, said the roads were suitable as regarded gradients and widths. Some widenings and street improvements would be carried out, and the tramways account would be debited with half the cost.

In cross-examination, Witness said the cost of the tramways on the Hagley Road would be £34,532, which amount included street works, tramways, and land, but it did not include the cost of cars and a proportion of the depôt. On the Harborne route the cost would be £77,643, including street works, tramways, and land, but exclusive of the cost of cars, and a proportion of the depôt.

Mr. Joy addressed the Committee for the opponents resident in Harborne, and asked that the tramways should be stayed until the proposed town planning scheme for Harborne and Quinton had become an accomplished fact. He protested against the picturesqueness of old Harborne being destroyed by trolley poles and wires.

On Friday, April 19th, the Committee deliberated in private, and the Chairman subsequently announced that the Committee felt that the matter under discussion was a very limited proposition. Subject to what the opponents might say, the Committee were of opinion that better means of access to the centre and other parts of the city should be provided for the Harborne and Quinton residents, but in view of the proposal to make the Hagley Road route (which they were disposed to accede to), and in view also of

the town planning scheme under consideration, the Committee considered that tramways 3 to 9, which comprise the route from Chad Road through to Harborne should be struck out of the Bill.

Mr. Balfour Browne, K.C., acquiesced on behalf of the Corporation in the Committee's decision, and Mr. Hutchinson, on behalf of the Edgbaston residents, and Mr. Macassey, on behalf of the London and North-Western Railway Co., intimated that they would defer their opposition to the Hagley Road route till the Bill was before the House of Lords Committee.

The clauses were then adjusted, and the Bill was ordered to be reported for third reading.

LEGAL.

Osram Lamp Works, Ltd., *v.* The "Z" Electric Lamp Manufacturing Co., Ltd.

On Monday, April 22nd, Mr. Justice Warrington, in the Chancery Division, commenced the hearing of this action. Plaintiffs are the registered legal owners of letters patent 23,899 of November 4th, 1904, for improvements relating to the manufacture of incandescent electric lamps granted to Dr. Alexander Just and Franz Hanaman; also letters patent 18,622 of August 20th, 1906, for an improved method of producing metallic incandescence bodies for electric glow lamps, granted to Philip Middleton Justice; also letters patent 8,563 of August 30th, 1906, for an improved process for the manufacture of metallic illuminating bodies adapted for electric incandescence lamps granted to the Deutsche Gasglühlicht Aktiengesellschaft. The defendants, it was alleged, had infringed and threatened to infringe the said letters patent, and plaintiffs asked for an injunction restraining the defendants, their agents, or workmen from so infringing, or offering for sale in this country any of the lamps complained of; damages or accounts of profits and delivery up of all infringing articles.

Mr. Astbury, K.C., and Mr. A. J. Walter, K.C., Mr. Colefax, Mr. Gray and Mr. Lunge for the plaintiffs; Mr. T. Terrell, K.C., Mr. Frost and Mr. Swann for the defendants.

Mr. Astbury, in opening the case, said the action related to three letters patent connected with the production of those metal-filament lamps which had taken the place of the old carbon lamps. The first two patents, Nos. 23,899 of 1904 and 18,622 of 1906, dealt with certain chemical arrangements as to the production of the filaments and the other patent No. 8,563 of 1906, referred to the physical method of producing the best kind of filament. Dealing with the first two patents, Counsel went through them at considerable length and in great technical detail. He pointed out that the lamps manufactured by plaintiffs were absolutely supreme, and it was only natural there should be a fight about them. These patents were the result of the labours of chemists of considerable repute, Dr. Alexander Just, Mr. Franz Hanaman and Philip Middleton Justice, and had regard to the incandescing of electric lamps—an incandescent body composed of tungsten. This metal had been applied to carbon filaments in the form of a coating with the object of preventing the disintegration of the carbon. The invention was the selection of this common tungsten metal with all its difficulties, which people thought could not be surmounted, and its direction to subject that metal to a treatment which in part was known from other bodies and part was unknown, but, as a whole, it was the selection of tungsten with the particular mode of decarbonising it. It was necessary in the making of a perfect filament, to get the carbon in the filament and then get it out again. If the carbon was left in the finished filament, then the filament would disintegrate, and would not be of any use. It was absolutely essential to get the carbon out of the completed filament. It was previously got rid of in various ways, but what was done in one would not do in another. In the process of getting the carbon out, it had to be done in such a way as not to oxidise the tungsten, which was like iron and would rust very easily. This seemed a difficult thing to do, but hydrogen was the protective atmosphere for tungsten or other oxidisable metal. What the plaintiffs claimed here was incandescing bodies for incandescent electric lamps consisting of tungsten. That meant incandescent bodies for incandescent electric lamps, viz., filaments consisting of tungsten, which were made not by trying to get carbon with tungsten and not by trying to substitute any other body or metal, but those which were manufactured in this particular process in accordance with claim one of the first patent. In regard to the second patent, that claimed the process for chemically removing the carbon. In this particular case, counsel submitted, the defendants had infringed absolutely, because they utilised steam and hydrogen as described in the specification. The first claim was, therefore, for the filament which had to be made by a building-up process, as distinguished from any one of the other processes. The words "substantially and in the manner described" in the claim enabled one, when the question of infringement was come to, to say what departure, if any, had been made, and whether it was one of substance or not. There was no doubt as to infringement, as plaintiffs obtained from defendants some filaments—fine ones—about two dozen, for lamps that were an infringement of the plaintiffs' lamps, together with an admission that defendants were making similar lamps for sale in this country. Defendants made lamps of all sorts and sizes, and plaintiffs alleged that they infringed by all of them. It was at first difficult to detect the infringement with the lamps in question, as they had such very delicate filaments, and plaintiffs endeavoured to secure some thick ones, but defendants refused to supply them. It might be necessary even now to have to ask his Lordship for an order at some stage of the proceedings to allow the plaintiffs to inspect the thick ones.

Mr. Astbury here handed up to his Lordship one of the lamps in question and said his Lordship would see by placing some white paper at the back, that the filament could just be perceived. From that his Lordship would appreciate how difficult it was for plaintiffs to ascertain how far defendants had infringed. Describing the defendants' process, counsel said what defendants did was this—they took the filament when it came out from being carbonised and treated it in a jar and put it in a protective hydrogen atmosphere. There were no steps taken to avoid the natural moisture of the jar, and the moisture could be seen during the process. That process lasted for a certain number of seconds, and during that time they did precisely and in terms what was described in plaintiffs' patent—they subjected it to a current in an atmosphere of steam and hydrogen and then raised it to a high temperature, and by that process it was oxidised. Prior to mounting it in the globe, they painted phospham and phosphorous on to the stem and then attached the globe to a vacuum pump, and during the first two minutes they subjected the outside of the glass to a baking temperature of about 300° C., which was just under the softening point of glass. That was done to get rid of any oxygen in the bulb—the presence of phosphorous assisting that process. They then turned on the current and kept the filament at a red glow, at which the temperature was somewhere between 600° and 800°, and that was kept up for about 10 minutes. That rendered it definitely impossible for any trace of oxygen to be left. They then put on a strong current, bringing it up to about 2,000°, which was kept going for about 20 minutes, still using the pump. Plaintiffs said that during that 10 minutes, and certainly during the 20 minutes, there was, in fact, a reduction of the carbon in the filament. There was, however, still '02 of carbon still in the filament, instead of '08 when the lamp was completely finished. During the last 20 minutes of the process, defendants could not say there was no carbon to act upon. Why did so many eminent men worry about other various metals in endeavouring to arrive at the results plaintiffs had obtained with tungsten? The reason was because it never occurred to any of them.

His Lordship: It was only by experiments that you could find that a metal would do what you wanted it to.

Mr. Astbury continuing, said with regard to the third patent, it was necessary to appreciate certain chemical facts to understand it properly. This patent was to do a thing that if one did not know that it would do it, would be absolutely idiotic. The invention had altered the whole trade in metal filaments, and plaintiffs were turning out lamps with these filaments at the rate of hundreds of thousands per week. By the invention, it was possible to get a metal filament to burn on a 200-volt circuit, and give a 16-c.p. light. It was only necessary to be told that nature would allow this thing to be done. The invention was to put a weight on the filament before the decarbonisation was begun, and it would go through that operation. It was possible to put a weight on heavy enough to make them go to an acute angle, and still it did not pull them apart—and the maker got no wasters at all. They were dead straight and had a perfect point, so that it was possible to cut them with perfect precision, so that all the lamps could be standardised. In this case infringement was admitted. The only contest here was that defendants said there was no subject matter, because plaintiffs put a weight on for a purpose at a different period. For years, said counsel, after the metal-filament making was started, and before this patent was brought out, plaintiff used to do that operation without a weight, and lost enormously through it.

Mr. Terrell said infringement was admitted in this sense. The lamps that they had alleged in the particulars of breaches were operated on by weights. Before the issue of the writ, the weights were abandoned and never had been used since.

His Lordship: That means that you admit that you did infringe.

Mr. Terrell: Yes, that we did infringe the patent in the lamps that are complained of in this action.

His Lordship: That means that there was an infringement of the patent, but at the date of the issue of the writ you were not threatening and intending to infringe.

Mr. Terrell: As a matter of fact, we do admit infringement because we did put the weights on the lamps. But since that we have abandoned it, and before the issue of the writ. On that statement, we are guilty of infringement.

Mr. Astbury: I cannot accept that statement for the purposes of this case, because the writ is dated June 30th, 1911, and on January 19th, 1912, there was an admission by counsel for the defendants in Court, on which plaintiffs did not get any further order, that defendants had infringed.

His Lordship: I will hear Mr. Terrell on the point, but *prima facie* it would seem you were entitled to an injunction if the patent is right.

(*To be continued.*)

Correction.—With reference to the case of Webb *v.* Booker, reported on page 619 of our last issue, two errors unfortunately crept in. It was stated that Mr. Booker was manager of J. & H. Grevener, Eldon House, Eldon Street, E.C. We learn that Mr. Booker is an engineer in one of the firm's departments, and not *manager*. Furthermore, their present address is not Eldon Street, but 40, Southwark Street, S.E.

THE "IDEAL HOME" EXHIBITION.

Those who have not already paid a visit to this beautiful show at Olympia, ought not to let the opportunity slip—it remains open until the 30th inst., and is certainly one of the prettiest and daintiest displays we have seen. It is also extremely popular, and it appeals to the very class of people that the electrical contractor and the supply station manager want to get hold of. It is all the more regrettable, therefore, that so meagre a display of electrical apparatus is on view, and that the opportunity was not seized by the Publicity Committee and its allies, to repeat the success attained last month at the Agricultural Hall. Indeed, we say without hesitation that it would have been far better for their joint exhibit to be at the Ideal Home Exhibition than at the Smoke Abatement Exhibition—if a choice had to be made; but best of all, to be at both.

We learnt from the few electrical exhibitors that they had done very satisfactory business, and the fact that to one petrol-electric country house lighting set, no fewer than seven "sold" tickets were attached, speaks for itself. We trust that the lesson will not be thrown away, and that next year, or whenever the Ideal Home Exhibition recurs, the electrical industry will be present in strength.

Of the electrical exhibits, precedence must be given to the stand of Messrs. Duncan Watson & Co., the only one, we believe, which gives a comprehensive display of the leading features of electricity as applied to domestic purposes. Besides a complete electric lighting plant for a country house, and a smaller one for lighting a cottage or bungalow, the company show a variety of tasteful fittings of their own design and manufacture, their electric vacuum cleaners, radiators and cooking appliances—the last in charge of a skilled lady cook, who appears to be indefatigable and enthusiastic in demonstrating the excellencies of electric cooking. A special display is also made of "Stannos" wiring, which the company are using extensively, and with very satisfactory results. Our congratulations and thanks are due to Mr. Duncan Watson for upholding the honour of the electrical industry.

But several other firms have excellent, though less comprehensive, exhibits. Messrs. Tredegar & Co. also show a country-house lighting plant, and their surface wiring system, in which Stannos wire is employed, and a variety of their own wood and metal electric lighting fittings. Messrs. Elkington & Co., Ltd., show their beautiful plate, and the Galvanit Manufacturing Co. and the Silver Replating Powder Co. their home replating processes. Vacuum cleaners are legion; electrical cleaners are shown by the British Vacuum Cleaner Co., Ltd., the Imperial Electric Co., Ltd., the Wizard Dust Extractor Co., Ltd., Daisy Vacuum Cleaners, and last but not least, Magic Appliances, Ltd., who as usual have a special attraction, in the form of a negro in white uniform manipulating their suction cleaners.

The Harvey Electro-Chemical Co., Ltd., show their process for electroplating china and glass ware, which we recently described.

The Perfectophone, Ltd., show a gramophone with an automatic electric stopping device, to prevent over-running and consequent injury to the instrument.

Messrs. Hammond & Champness, Ltd., have an electric lift conveying passengers to the gallery, and electric service lifts. Demonstrations of electric cooking are given by Messrs. Frank Staines and Co., Ltd., and Ozonair, Ltd., show their ozone generators in operation. Electric lighting apparatus and fittings are included in the exhibit of Messrs. Strode & Co., and the Foster Engineering Co. show their metal-filament lamps. Messrs. Edmundson's Electricity Corporation, Ltd., and Messrs. R. A. Lister & Co., Ltd., have automatic electric lighting plant for country houses, &c., the latter having several "Lister-Bruston" sets in operation, one of which is labelled sold to Mr. H. H. Asquith, while another—not working—is of 10 h.p., and is suitable for bioscope shows.

The Dowsing Radiant Heat Co., Ltd., exhibit a variety of their radiators, electric light baths, &c. In the Dutch Village Messrs. E. C. Sparkes & Co. show the Stokvis electric fittings. The effect of high-frequency electric oscillations on the growth of chickens is demonstrated at a chicken farming stall, by the *Daily Mirror*.

In the British Furniture Section electric fittings are shown by Messrs. Charles Spooner, J. Brandt and A. Romney Green.

The whole of the electrical fittings for the "Ideal House" itself, the dominating feature of the Exhibition, were supplied by Messrs. F. & C. Osler, Ltd.—for, of course, the ideal house must be lighted with electricity—and a Lister-Bruston generating plant supplies the necessary current, this being mounted on a layer of "Korfund" to prevent vibration. Messrs. John Barker & Co., Ltd., were the contractors for the furnishing and decoration, including the electrical installation.

While we have thus touched upon the electrical features of the Exhibition, we should point out that gas lighting, cooking and heating apparatus are extremely well represented; automatic installations for country houses are prominently shown, and it must be admitted that, in spite of the difficulties and drawbacks inherent to the use of gas in any form, our rivals make a very interesting display. All the more reason, therefore, for us to see to it that our industry is more adequately represented on the next occasion.

It is interesting, and somewhat amusing, to note that for the "'Seal'ed gas oven" which is exhibited the makers claim all the advantages claimed for electricity, and notably "*minimum of wastage of food cooked—saving upon ordinary system.*" Comment, in the stock phrase, is superfluous.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Rectifier for Converting A.C. to D.C.

A simple and ingenious device for converting alternating current to direct has been introduced, in the shape of "rectifying nets," by Messrs. C. Schniewindt, of Neuenrade, Westphalia, Germany. These nets are placed in glass jars filled with water, in each of which is placed a small quantity of bicarbonate of soda, which are afterwards connected up like cells. The special nets are composed of iron and aluminium wires woven with asbestos, as shown in fig. 1. Only that current impulse of an alternating current up to 100 volts will be transmitted, for which the iron wires are the

Fig. 1.—Schniewindt "Rectifying Nets."

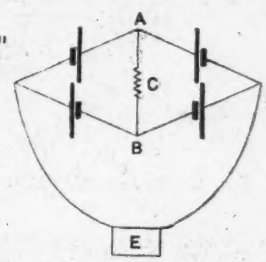


Fig. 2.—Connections to give Continuous Current.

positive electrodes, so that half of the rectified alternating current is obtained in the circuit as direct current. By connecting the cells as in the diagram, fig. 2, in which the short dashes represent the aluminium wires, and the long dashes the iron electrodes, it is possible to obtain between the points A and B a direct current of 75 per cent. efficiency, the heating of the electrolyte accounting for the deficiency; E represents the source of supply, and C the consuming circuit. These "rectifying nets" can be used for converting A.C. to D.C., in connection with the charging of accumulators, and for numerous other purposes.

Rhadoonit.

We have received from Mr. Charles A. Müller, of 10, Arcade, Westgate, Bradford, a sample of "Rhadoonit," a new insulating material which he is introducing into this country. It is a hard black material, but we are informed that it is easily worked, fireproof, absolutely non-hygroscopic, and does not warp; it has a very high insulation resistance. Tests made at the P.-T. Reichsanstalt, Charlottenburg, with plates of Rhadoonit 23 mm. thick, at 10,000 volts, showed an insulation resistance of 1 million megohms in the dry state, and 800,000 megohms after immersion in water for 24 hours; there was no appreciable increase in the weight of the plates after immersion, and they were not pierced with a pressure of 36,000 volts (the highest available) applied for half an hour, before and after immersion in water.

One of its principal uses is as a substitute for marble and slate, as base plates for electrical apparatus, &c., it being made in slabs from 10 to 40 mm. thick, of any size up to 3 ft. 6 in. × 5 ft. It resembles enamelled slate, and takes a high polish.

Amongst other users in this country is the Bradford Corporation Electricity Department.

Witton-Kramer Electro-Magnetic Clutches.

The accompanying illustration, fig. 3, shows a magnetic clutch, manufactured by the Witton-Kramer Tool and Hoist Co., for whom the General Electric Co., Ltd., act as sole selling agents; it consists of a thick disk of high permeability steel, keyed to the main shaft, carrying pole pieces to which the magnetic coils are fitted. The ends of the coils are connected to suitable slip-rings to which the current is conveyed by means of brushes. A sheet-iron cover is

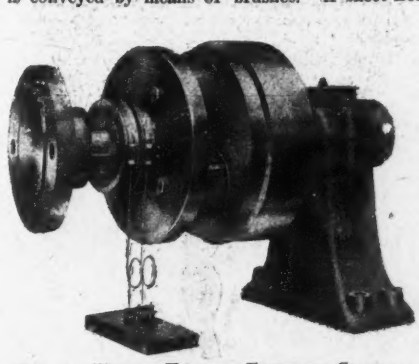


Fig. 3.—Witton-Kramer Electric Clutch.

provided to protect the coils from external injury (this cover being removed in the illustration to show the coils). To the pulley or driven shaft a soft wrought-iron disk is fitted, and when the

F

magnet coils are excited this disk is attracted to the pole shoe and thus caused to rotate with the main portion of the clutch. In this design the power consumption does not average more than about 3 watts per H.P. transmitted, and is an almost negligible item. The clutches are made in varying sizes to transmit from ½ H.P. up to 1,000 H.P. They are wound for continuous current only.

Combined Cord-Pull Switch and Ceiling Rose.

Messrs. A. P. Lundberg & Sons, of 477 to 487, Liverpool Road, Islington, N., inform us that they have had a combined ceiling rose and pull switch on the market for about six months.

Fig. 4 shows one use of this accessory. The flex comes through an insulation-bushed hole in the cover, the latter being fixed by the

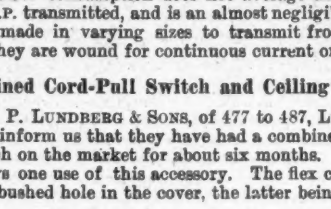


Fig. 4.—Combined Ceiling Rose-Switch with Lamp.

makers' patent locking-ring method. Fig. 5 shows the interior of the combined switch and rose; right in front are the holed projections on the porcelain base through which the flex is threaded. The switch in this case is for hand manipulation, the feed wire coming from below, and the flex would run up the wall therefrom.

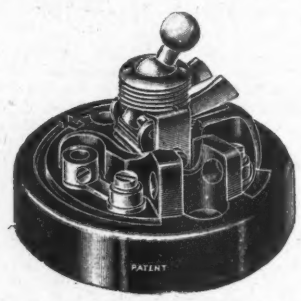


Fig. 5.—Combined Switch-Rose for Wall Fixing.

Messrs. Lundberg now have in hand, to meet the demand, a special pattern having a groove in the base, to enable the combination to be used with twin-lead and similar surface wiring.

Loxley H.V. Patent Ceiling Rose.

An entirely new departure in ceiling roses has been marketed by Messrs. Loxley & Co., Ltd., Basinghall Street, Leeds. As shown in fig. 6, the brass parts of the rose are completely sunk in the china

Fig. 6.—Loxley Ceiling Rose.

base. The terminal consists of two upright plates clamped together by a long screw and washer, passing through the china. One plate is thick and one thin, so as to form a close springy contact. The cable and flexible are clamped into the same clip. The ceiling rose, in fact, consists of two pairs of plates, two screws, a china cover, and body. It is entirely English made, and is suitable for high-voltage work, as all metal parts are well sunk. It has no metal parts on the back, no dumb-bell plates, pillar contacts or weak flexible connections.

Under actual test this ceiling rose has supported a load of 56 lb. hung from the flexible, whereas an ordinary ceiling rose tested under similar conditions failed to support a load of 21 lb. We have verified the fact that main force is required to tear the flexible out of the rose.

The makers claim that it is quicker, easier and cheaper to fix than the ordinary ceiling rose, and its size, 2⅛ in. diameter × 1⅛ in. high, makes it a neat and small ceiling fitting, which can be placed on a 2½ in. block. It costs no more than the ordinary English ceiling rose.

Electric Reflector Stove.

Messrs. F. A. Wilkinson & Partners, Ltd., of Harpenden, Herts., have brought out a combined Reflector stove, toaster and radiator, shown in fig. 7. The apparatus is made in polished aluminium throughout, and consists of a reflector fitted with an expanded steel top and clip ring. The heating element is similar

Fig. 7.—Electric Reflector Stove.

in appearance and size to an ordinary incandescent lamp, but is fitted with pins for connecting to a plug base within the reflector casing, thus being instantly removable. The apparatus forms a quick boiler, a rapid toaster and an artistic radiator. The heating element is made for any standard voltage, the consumption being 700 watts working at bright red heat. Ordinary household utensils are used.

BUSINESS NOTES.

Electric Clocks.—The following are some electric clock installations which Messrs. Gent & Co., Ltd., of Leicester, have in hand:—

India Office.—Thirty inside clocks, and one two-faced turret clock with 4-ft. dials.

Hartlepool Customs House, for N.-E. Railway.—One four-faced turret clock, with waiting train movements, and a large number of indoor clocks.

New Locomotive Offices, Darlington, for N.-E. Railway.—Fifty indoor clocks.

David Colville & Son, Ltd., per Edward & Son, Glasgow.—One four-faced turret clock, with waiting train movements, and a number of indoor clocks.

Torquay Town Hall.—One four-faced turret clock with waiting train movements, 5 ft. 6 in. dials, and a number of ornamental indoor clocks.

Blackburn Police and Sessions Court, per T. Burton & Co., Blackburn.—Transmitter, controlled from Greenwich, and a number of indoor clocks.

Pretoria Railway Station, S.A.

Cavendish High School for Girls, per W. R. Saunders, Buxton, for the Derbyshire Education Committee.

Sir David Salomons, Bart.—Prime transmitter, and a number of sub-control transmitters.

Canadian Pavilion, Festival of Empire.—Turret clock, with four 5-ft. dials.

Glamorgan County Hall, per Ellis & Ward, Cardiff.—One transmitter with 21 clocks.

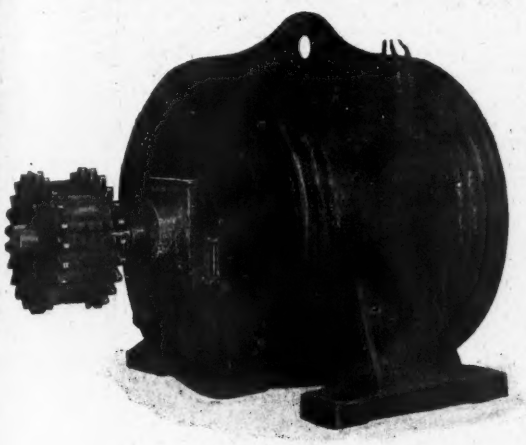
Cadbury Bros.—Repeat orders.

Dunecht House, Aberdeenshire.—Illuminated turret clock, and several house clocks, per the Aberdeenshire Electrical Engineering Co., Ltd., Aberdeen.

Advances in Prices.—Messrs. Mavor & Coulson, Ltd., of Glasgow, announce that, owing to the increase in the cost of raw materials, selling prices are increased from April 15th by a reduction of the discounts on their price lists for generators and motors by 10 per cent.

The Sterling Telephone and Electric Co., Ltd., announce that, owing to the continued serious rise in the price of all classes of raw material, they are obliged, as from April 22nd, to raise prices of wires, cables, insulators, ironwork and medical coils by 10 per cent. This advance includes the items excluded from the firm's notice published in our issue of March 29th, and the 10 per cent. advance will now apply to the whole of the Bell Section of their catalogue (items listed under "S").

A Tough Motor.—Messrs. T. W. Broadbent, Ltd., of Huddersfield, who attach some importance to the robustness of design and construction—electrically, in particular—of their "N" type three-phase motors, have sent us an instance of the way in which these motors will stand up to their work under conditions of abnormal overload. A 15-B.H.P. "N" type motor running at 955 R.P.M. and working on a three-phase 400-volt, 50-cycle circuit, was employed for driving some pumping machinery through a raw-hide pinion. The pinion was 7¾ in. pitch diameter by 4 in. wide over flanges. For some reason the pump must have jammed or one of its bearings seized, but, as is often the case in practice, the fuses were heavily wired, and the motor evidently continued to run for some little time after this occurrence, before its load became sufficient to cause the circuit breaker on the switchboard to throw out. The condition of the motor when taken for repair is shown in the illustration, and is evidence that it had been working against an overload that would probably have injured the stator windings and insulation, and the rotor connections of any motor not constructed on very substantial lines. The shaft was badly twisted and bent, and the



A Tough Motor.

teeth of the pinion had been completely stripped off, only the teeth on the gun-metal flanges remaining. The spur wheel into which the pinion was geared appears to have fouled the outer flange of the pinion and the rotor shaft had been forcibly drawn in the direction of the pump. This forced the driving end bearing bush of the motor outwards, the bush being badly ploughed up by the set-pin, which had held it in position. Notwithstanding the abnormally heavy overload that must have been put on the motor, the stator and rotor windings were wholly uninjured by the accident. The insulation resistance of the stator winding was found to be four megohms, and a pressure of 1,000 volts alternating was then applied between the windings and frame of the motor. After the rotor shaft had been straightened and a new bush fitted to the driving end bearing, the motor was tested, and returned to its owner; and it is now running as usual. No repair of any kind was made to either the stator or rotor windings. This, Messrs. Broadbent say, serves to support their claim that their "N" type three-phase motors are practically indestructible even under extraordinary working conditions.

Catalogues and Lists.—The British L.M. Ericsson Manufacturing Co., Ltd., Byron House, 82, 85, Fleet Street, London, E.C.—We have received the A. C. section (about 100 pages) of the firm's new catalogue of telephone instruments. Excellent half-tone blocks, brief descriptive notes, weights, dimensions, and code-words, are given of the following lines:—Section A (1) magneto telephones:—Wall instruments (ordinary and mine telephones; telephone with special protection against H.T. currents; telephone and sounder combined, for use on telegraph lines; automatic call-boxes; meter; telephone and automatic call-box combined). (2) Table telephones (ordinary telephones; extension telephone without generator or bell; intermediate wall telephones; intermediate table telephones; extension switches with chart). Section B, battery ringing telephones:—Wall and table types; wall telephones for railway work; extension switches. Section C, common battery telephones:—Wall and table types; intermediate and sub-station telephones; extension switches. Accompanying the section is a separate eight-page price list, very clearly setting out the prices for the above-named instruments.

Messrs. Balcke & Co., Ltd., Broadway Court, Broadway, London, S.W.—New 20-page catalogue (No. 303) containing full information, accompanied with numerous illustrations, regarding their "Unic" steam traps which are built on new principles. A table of prices and dimensions is included.

Allgemeine Elektricitats-Gesellschaft, Berlin.—Pamphlets describing electrical point-shifting devices, and the 400-H.P. "Abraum" locomotive of the A.E.G.

Mr. Chas. E. Miller, 97-103, Reade Street, New York.—256-page catalogue (No. 22 of 1912) giving illustrated particulars, with prices, of supplies for automobiles, motor boats and cycles and motor planes.

The Foster Engineering Co., Ltd., Wimbledon.—Leaflet giving some particulars of the Foster electric geyser for alternating current. It is supplied in "small" and "bath" sizes respectively. In the smaller one two pints of water can be raised per minute from 55° to 110° F. The water-containing vessel is of solid copper, and all insulation is by the Foster special fire-proofing process. The switch plug at top is mounted on a polished hardwood base. Prices are stated.

The Crypto Electrical Co., 149 and 159, Bermondsey Street, London, S.E.—Lists with brief specification and prices of the following:—Crypto small transformers; combined motor-generator; new pattern combined A.C. to C.C. transformer; standard pattern A.C. to C.C. transformers for battery charging and cinematograph arc lamp lighting.

The Carron Co., Carron, Stirlingshire.—A very attractive and effective showcard (19 in. × 14 in.) has been issued, showing the Carron electric cooking range and the satisfaction of the cook therewith.

Messrs. Haes & Eggers, Ltd., 163, Clarence Street, Sydney, N.S.W.—This firm has favoured us, as in recent years, with one of its desk blotting pads with right hand diary. The latter is interleaved with blotting, and the opening pages contain illustrated information respecting the manufactures of firms for whom Messrs. Haes & Eggers, Ltd., hold Australian agencies.

Messrs. Berry, Skinner & Co., 78, Upper Thames Street, London, E.C.—Leaflet relating to electric driving in textile factories showing a cotton-doubling mill driven by 60 Wright & Wood three-phase squirrel-cage motors.

Allgemeine Elektricitats Gesellschaft.—Pamphlets on the cost of electrical work in agriculture, on electric ploughs, and on pumps for liquid manure.

Mr. C. Schniewindt, Neuenrade, Westphalia.—Leaflet relating to "Cord" resistances for electric heating elements.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—Mailing Card No. 184, gives particulars of the firm's new flexible desk standard.

Liquidations.—The Stassano Electro Steel and Furnace Co., Ltd.—This company is winding-up voluntarily, with Mr. Augustus Hobbs, 4, Sotheby Road, Highbury, as liquidator.

Winchester Electric Light and Power Co, Ltd.—A meeting is to be held at Broad Sanctuary Chambers, Tothill Street, Westminster, on June 5th, to hear an account of the winding-up from the liquidators.

The Proposed Aluminium Syndicate.—It is announced from Paris that the representatives of the French, Swiss, English, and American makers of aluminium met recently in that city to further discuss the question of reviving the International Syndicate which collapsed in October, 1908. An agreement in principle was reached by the establishment of a basis for a new combination, and the negotiations are to be continued in June or July, when it is thought the syndicate will be brought into existence. The resumption of the negotiations last year has been followed by a hardening of prices, as the price in Germany in October last ranged from 54 marks to 57½ marks per cwt., whilst at present the rates are from 62½ marks to 66½ marks per cwt., according to quantity.

Private Meeting.—William Kirtley and Thomas Oliver Dunford, trading as Kirtley & Dunford, electrical engineers, 14, Tower Street, West Hartlepool. The creditors of the above were called together recently when a statement of affairs was presented showing ranking liabilities of £466. The indebtedness to the trade was £333, and there were unsecured cash creditors for £134. There were fully secured cash creditors for £346, the charge held consisting of certain land and buildings at West Hartlepool. The National Provincial Bank were also creditors for £200, their security consisting of the deeds of a house. There was another fully-secured cash creditor for £46, who held certain furniture valued at a like amount. The assets were estimated to produce £211, less £23 for preference claims, leaving net assets of £188, or a deficiency of £278. After discussing the position a resolution was passed in favour of the estate being wound up under a deed of assignment with Mr. White, of West Hartlepool, as trustee. A Committee was also appointed, consisting of the representatives of Messrs. Hanson, Brown & Co., Ltd., Messrs. John Pounder, Ltd., and the General Electric Co., Ltd.

Meeting of Creditors.—The Bradford Electrical Co., Ltd.—At the statutory meeting of creditors, held at the offices of Mr. J. H. Haley, incorporated accountant, Bradford, last week, creditors representing £724, out of a total unsecured indebtedness of £796, were present. A statement of affairs showed assets amounting to £468. After deduction of £18 for preferential creditors' claims, a deficiency was shown as regards creditors of £347, the deficiency as regards shareholders being £612. Mr. Haley explained that the business was acquired from the old company in January, 1910, and that it had been unprofitable from the commencement. The total trading loss amounted to £328. The turnover had averaged about £2,500 per annum. The directors had not received any fees for their services. It had been decided that unsecured trade creditors should be paid their accounts subject to a special discount of 15 per cent., which had been accepted by many of them prior to the liquidation. The creditors in the liquidation also were to be paid an amount equivalent thereto, which meant that the shareholders, in addition to losing their share of the capital, would provide a sum approximating at least £300 to enable this to be done. The appointment of Mr. Haley as liquidator was confirmed.

Book Notices.—"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXI, No. 4. April, 1912. New York: The Institute. Price $1.

"*Journal* of the Franklin Institute." Vol. CLXXIII, No. 4. April, 1912. Philadelphia, Pa.: The Institute. Price 50c.

"The School of Mines Quarterly." Vol. XXXIII, No. 3. April, 1912. New York: Columbia University. Price 50 c.

"*Transactions* of the Concrete Institute." Vol. IV, Part 1. March, 1912. London: The Institute.

"Central Station Heating." By Byron T. Gifford. 1912. New York: Heating and Ventilating Magazine Co.

"*Bulletin* of the Massachusetts Institute of Technology." 1912. Vol. XLVII, No. 2. Boston: The Institute.

"Post Office Electrical Engineers' Journal." Vol. V, Part 1. April, 1912. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

"Annales des Postes, Télégraphes et Téléphones." March, 1912. Paris: A. Dumas. Price 6 fr.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." 1911-12. Glasgow: The Institution.

"*Journal* of the United States Artillery, with Index to Current Military Literature." Vol. 37, No. 2. March—April, 1912. Fort Monroe, Va.: Coast Artillery School Press.

"Studies in Terrestrial Magnetism." By C. Chree. 1912. London: Macmillan & Co. Price 5s. net.

Messrs. S. Rentell & Co., Ltd., are now selling a new American text-book entitled "Telephony," by Messrs. Saml. G. McMeen and Kempster B. Miller, who are acquainted with the very latest developments in this branch of electrical science. It is published in this country at the price of 17s. net.

Trade Announcements.—Mr. John G. Mackintosh, electrical engineer, 1, North Street, David Street, Edinburgh, has purchased the business carried on by Messrs. D. T. Neil & Co., electrical contractors, 166, Great Junction Street, Leith. He will continue the latter business under the same name and at the same address.

Messrs. S. Bill & Co., of Park Road, Hockley, Birmingham, have amalgamated with the Premier Cabinet Co., of Hunter's Vale, Hockley. Both businesses will, in future, be carried on under the style of S. Bill & Co., Ltd.

The Corona Lamp Works, Ltd., Ascham Street, St. Pancras, London, N.W., have appointed Mr. Frederick S. Dinenage, of Birmingham, as their provincial representative. Mr. Dinenage has been associated for some years with the Edison & Swan United Electric Light Co., Ltd., and established the Ediswan Nottingham branch, prior to his appointment as Birmingham district superintendent and manager of the Birmingham depôt of the Edison and Swan United Electric Light Co., Ltd., which he is relinquishing at the end of this month to take up his new position with the Corona Lamp Works, Ltd.

Australia.—H.M. Trade Commissioner for Australia reports that an electrical engineer who has had considerable experience in the electrical trade in Australia and New Zealand, is shortly visiting England with a view to obtaining the agencies of British manufacturers. Apply to Commercial Intelligence Branch of the Board of Trade.

Bankruptcy Proceedings.—The first meeting of creditors was held on Wednesday last week at the London Bankruptcy Court, under the failure of Henry John Wright, 211, Upper Thames Street, London, E.C.—The debtor, who filed his own petition, was for some seven years before 1908, engaged as a salesman by Croggon & Co., Ltd. In August, 1909, he became manager of the Ferabin Lamp and Electrical Accessories Co., Ltd., of 118, Queen Victoria Street, E.C., and financed the same to the extent of £300, all of which he borrowed, being allotted shares to the same amount in the company. The chairman stated that the company only lasted 10 months; the debtor's shares were never of any value, and were now charged in favour of creditors. The debtor had been pressed for the balance of the money that he had borrowed on its behalf, and being unable to pay, he was advised to file his petition. At the present time he was engaged as a traveller, and he attributed his failure to his having borrowed money as before mentioned. A statement of affairs had been lodged showing liabilities £485, of which £305 were returned as expected to rank against the estate, and assets nil. The chairman added that no proposals for the payment of a composition had been lodged by the debtor, who had consented to an order of adjudication. The case was left in the hands of the Official Receiver.

LIGHTING and POWER NOTES.

Abercarn.—The B. of T. has informed the U.D.C. that it has granted it a prov. order authorising the transfer of the undertaking to the South Wales Electrical Power Co.

Accrington.—Messrs. Higham Bros., a large firm of cotton manufacturers, have decided to equip their new shed at Woodnook on the individual-drive system—a separate electric motor to every loom. The new mill will be driven by 500 motors, and the consumption will average nearly half a million units per annum. The majority of the looms are large and heavy, requiring extra large motors. The order for the motors has been given to the Scorch Electric Co.; this is stated be the first undertaking of the kind in this part of Lancashire, but several firms in East Lancashire are experimenting with the individual-drive system.

Ardsley.—The B. of T. has granted a prov. order to the Electrical Distribution of Yorkshire, Ltd., for electric supply within the area of the Ardsley U.D.C.

Argentina.—The *Review of the River Plate* publishes the following list of cities and towns which have electric light stations, or in which concessions have been granted. It does not guarantee the list as correct. La Plata, Florencio Varela, C. de Patagones, Mercedes, Chivilcoy, Dolores, Pergamino, Necochea, Carmen de Areco, Lujan, Bahia Blanca, Punta Alta, San Fernando, General Alvear, Coronel Vidal, Campana, San Pedro, Zarate, San Nicholás, Moron, Junin, Chacabuco, Navarro, 25 de Mayo, Saladillo, Chascomus, General Belgrano, Las Flores, Dolores, Azul, Olavarria, La Madrid, Coronel Suarez, Pigué, Dorrego, Tres Arroyos, Mar del Plata, Balcarce, San Martin, Trandil, Ayacucho, Maipu, Pringles, Suipacha, Bragado, Avellaneda, Lomas, Trenque Lauquen, City of Buenos Ayres, Corrientes, Goya, Monte Caseros, Mercedes, Curuzu-Cuatiá, Posadas, Paraná, Victoria, Concepcion, Concordia, Gualeguay, Gualeguaychu, Catamarca, Rioja, San Juan, San Luis, Villa Mercedes, Mendoza, Salta, Santiago del Estero, La Banda, Jujuy, Tucumán, Cordoba, Villa Maria, San Francisco, Bell Ville, Rufino, Santa Fe, Rosario, Coronda, Galvez, Rafaela, Esperanza, Reconquista, San Carlos Centro.

The Rosario Electric Light Co. has just completed its new power station at Sorrento, one of the near suburbs of the town, and it is hoped to have it in thorough working order before long.

The Municipality of Trenque Lauquen has signed a contract with Mr. Breemana for the installation of electric light in that town.

Barnsley.—The borough electrical engineer has been authorised to purchase 50 metallic-filament lamp cluster fittings, 600-c.p. size, at an estimated cost of £125, and these will be substituted for 50 of the existing arc lamps in the borough.

Bexhill.—The Council has decided to purchase an electric commutator grinder from the Brush Co.

The question of holding a demonstration of electrical cooking and heating apparatus has been under the consideration of the Corporation. The matter has been referred to a Sub-Committee. It is proposed to hold the exhibition in June.

Canada.—A Bill has been introduced in the Provincial Legislature of Ontario, conferring on the Hydro-Electric Commission the following powers, amongst others:—To take over existing power transmission lines and to improve water powers, by assisting municipalities and others in the storage of water, making of sluices, &c. To regulate the installation of electrical equipment and of wires in all buildings, including private houses. To control absolutely light and power rates charged by municipalities, whether these municipalities take power from the Commission or not. To direct the disposal of surpluses earned by municipal power plants supplied by the Commission. To order all wires under its jurisdiction to be laid underground in cities and towns. With the co-operation of the Dominion Railway Commission to order to be laid underground all wires in streets where the municipalities construct tunnels or conduits to carry such wires.—*Board of Trade Journal.*

Continental Notes.—Austria.—The proprietors of large cotton mills at Tannwald, Bohemia, have decided to establish an electricity generating station near Steinmuhle for the supply of the energy required for lighting and power purposes in the mills.

France.—The region of which the large city of Besançon is the centre is to be supplied with electricity from a hydro-electric station which is to be built on the River Loue. A society concerned with the utilisation and regulation of various rivers in the Department du Doubs is the promoter of the undertaking.—*Revue Pratique de l'Electricité.*

A company has lately been formed at Orleans with a capital of £180,000 and the title La Compagnie Electrique de l'Orleanais to supply electricity for lighting and power purposes in the Orleans district.

For the past three or four years the electricity supply of Paris has been in the hands of the Compagnie Parisienne de Distribution Electrique, familiarly known as the C.P.D.E. Commencing with January 1st, 1913, the scale of charges, which was lowered in 1908, will be further reduced, it being anticipated that the reduction will give an impetus to the demand for current. In view of this, the C.P.D.E. is at present engaged in entirely remodelling its system, nothing being overlooked in order to secure a modern organisation. A notable feature of the transformation work is that it is being effected almost without the existing consumers knowing it, there being no interruptions in the supply. One by one the old generating stations are disappearing, and by next year the whole of the current required in Paris will be supplied from two immense power stations—one of 75,900-kw. capacity at Saint Ouen, near the Seine, and another of 25,000-kw. capacity at Issy-les-Molineaux.

Holland.—Much activity is now being shown in the erection of generating stations in various parts of Holland. Among the towns concerned in such schemes are Zuidhorn and Ulrum, in the province of Groningen; Borger, in the province of Drenthe, and Achtkarshem, in Friesland. Electric lighting is also to be adopted along the high roads from Rotterdam to Overschie, and thence to Schiddam, a distance of about 8 km.

Portugal.—A scheme for the establishment of a central electric lighting station in the town of Penafiel is at present under consideration.

Dewsbury.—The General Purposes Committee of the Corporation recommends that a new turbo-generator, &c., be purchased at an estimated cost of £10,000, and that application be made to the L.G.B. for sanction to borrow that sum, in addition to £4,500 for distribution and service cables.

Falkirk.—The engineer has reported as to the sum required to be borrowed for the extension of the electricity works, and it has been agreed to apply for authority to borrow £15,000.

Golborne.—The B. of T. has informed the U.D.C. that it has decided to forthwith revoke the E.L. order, 1905.

Llandudno.—The Lighting Committee of the U.D.C. has been requested to consider a scheme for lighting the proposed extension of the Promenade.

London.—Hampstead.—A local paper states that the B.C. has decided to negotiate with Mr. E. Sayer (late chief assistant engineer), with a view to settling his claim for three months' salary in lieu of notice. The Finance Committee, which has been considering the expenditure on converting 2,359 street lamps for electric lighting, has made certain recommendations with a view to obtaining effectual control over the expenditure of the electricity department in the future. The Committee has also recommended that in future the work of the department should be under the direction of four heads of departments, and suggests that a chief engineer and manager (£750 per annum, with bonus of 2 per cent. on net profits about £4,500) be advertised for; that Mr. Leadbeater be appointed station engineer (£380 per annum, and bonus of 1 per cent.); that Mr. Durley be appointed electricity accountant (at £220 per annum and two-thirds of 1 per cent. bonus) he to remain a member of the borough accountant's department; that a mains engineer be advertised for on the salary basis last mentioned; and that Mr. Fox be appointed commercial manager also on the last-mentioned salary basis. A special meeting of the Council to consider the above was to be held to-night.

Marylebone.—The Electric Supply Committee reporting with regard to the advisability of continuing the Sales and Publicity Department on the present lines, states that the district auditor objected:—(*a*) To arrangements being made with only one contractor; and (*b*) to the particular method of dealing with the contractor's men; the department having, in the opinion of the auditor, been issuing its orders too much to the men direct and not enough through the contractor, at the same time he intimated that he would be perfectly satisfied by the adoption of a proposal made by the general manager, Mr. Seabrook, to the effect that each of the eight districts of the borough should be allocated to eight leading contractors in the borough, and in the event of there being more than eight contractors, the larger districts to be further divided, the arrangement, first of all, applying to all hire wiring work which would be sub-let entirely to contractors—both labour and materials, while the Council's district representative in charge of each district would be instructed to collaborate with the contractor who took each district, and the work done either on an agreed price or time and material basis. In order to meet the auditor's views, the Committee had been in correspondence with the Electrical Contractors' Association. At the last meeting held with the Association the following terms were suggested: (1) Wiring work to be offered to 25 selected contractors, distributed over the eight districts, to whom the work should be given in rotation; (2) the method of distribution to be agreed; (3) work to be done as a sub-contract for the department on terms to be agreed, possibly on the basis of a percentage on the cost of labour and materials; (4) the department to supply the materials at a scheduled rate, the contractors being paid the agreed percentage thereon as profit, but the latter having the option of obtaining such materials (being of equal quality) from any source, but would be paid at the same rate as though obtained from the department; (5) the department to be quite prepared (if desired) to pay weekly on account to within 20 per cent. of the work done, that the contractors would insure and as against third party risk; (6) contractors invited to bring their customers to the Council's showrooms to inspect fittings or apparatus, there to be no risk of the department intervening between the contractor and his customer; (7) facilities to be offered the contractors' men to attend meetings of the department's staff to be coached in business getting; (8) commission to be the same as paid to the department's representatives for getting consumers on the Telephone system. These terms, the Committee was under the impression, were approved of by the Association, but a reply had been received after it had further considered the matter, refusing to come to any working arrangement and reverting to the earlier position that the Sales Department should be closed down entirely. Notwithstanding the Association's decision, the Committee considered it expedient to pursue the original scheme, that it should be empowered to arrange with eight contractors to work on the lines put forward by Mr. Seabrook. The Committee, after going into the history of the Sales Department, states that the future development of the undertaking was very much dependent upon two things: (1) the increase in the sale of current for cooking and heating, and (2) the supplying of the poorer areas. It is quite obvious, the Committee continues, that the canvassing of the poorer districts for the small wiring jobs that have to be tackled, would not be worth the while of any contractor. With regard to heating and cooking—in the first place, the cost of getting the business in the early stages, and the knowledge of the business required, are such that the ordinary contractor could not reasonably be expected to undertake it. Therefore, if the department was to continue to develop and to earn a net profit, and so be able to reduce the general price of current, it was, above all things, necessary that these two branches of the work should be undertaken thoroughly, and this could only be done through its own staff. Concluding, the Committee states that, notwithstanding that it has frequently been stated that the department never cut prices, the turnover had been quite considerable, and was now over £20,000 per annum (including hire and hire-purchase scheme). This in itself showed that the consumers appreciated the convenience of having a sales department to deal with, and that it filled a public want. Being of opinion that the successful management of the undertaking rendered it essential that the sales department should be continued, it recommended accordingly, subject to the modification as to the method of sub-contracting referred to. At the last Council meeting this matter was not reached.

St. Pancras.—The Electricity Committee reports having considered a report from the chief electrical engineer in regard to the necessity of further extending the generating and transforming plant. He stated that since the installation of the last 2,000-kw. set it would be possible to install in the same space sets having a capacity of 5,000 kw. Although there would be some increased space necessary for condensing plant, instead of being able to put, as originally intended in the lay-out of the last extension, 6,000 kw. in the space, it would be possible to put in two 5,000-kw. sets, plus the existing 2,000-kw. sets, making a total of 12,000 kw. The cost of installing a 5,000-kw. set the engineer estimates approximately at £14,200, including switchboards and the necessary condensing plant and special foundations. In addition to this, the engineer considers it necessary to extend the machinery at the Tavistock Place sub-station by the installation of a further 1,000-kw. transforming set, similar to the one now at King's Road station, which he estimates at £2,400, including switchgear and foundations. He further advised the addition of a similar 1,000-kw. transforming set at the King's Road station. The adoption of these suggestions will incur an outlay of £19,000. The Committee being satisfied that the growth of the demand upon the undertaking is such that it is necessary to install the additional machinery suggested by the engineer, has decided to invite tenders for the supply thereof.

Hammersmith.—Agreements are to be entered into with the New Olympia Co., Ltd., and J. Lyons & Co., Ltd., for periods of seven and five years for the supply of current to Olympia and to the company's premises in the borough, respectively.

Manchester.—The Electricity Committee has considered its estimates for the year and offered £19,013 to the rates, or nearly £5,500 less than it gave last year. The £19,013 represents 1 per cent. on the outstanding mortgage debt, and the Committee would like to establish that basis for future contributions, but neither the Finance Committee nor the City Council has shown any disposition to approve such a basis. The Committee will again ask for £1,200 from the rates for street lighting, and it expects to spend on capital account a total sum of £74,000 next year as compared with an actual expenditure of £57,571 last year. Last year the Committee offered in their estimates £19,496 for the rates, but the City Council increased this to £24,500, which was actually paid.

Perth.—Conferences have taken place between the promoters of the Loch Ericht Electric Power Bill and representatives of the County Council, which has lodged objections to the scheme. There is a prospect the parties may come to terms. It is expected that the Bill will be read a second time in the House of Commons before the end of May.

South Africa.—The municipal authorities of Pietermaritzburg are obtaining sanction to borrow £50,000, of which £42,500 would be utilised for the purpose of extending the electric supply undertaking at that place.—*Board of Trade Journal.*

TRAMWAY and RAILWAY NOTES.

Aldershot and Farnborough. — The Light Railway Co. has applied to the B. of T. for an extension of time until June 4th, 1913, for commencing or completing the works authorised by the Light Railway Order, 1909.

Argentina.—The construction of the electric tramways in Mendoza is being rapidly pushed ahead, 12 km. of the 16 have already been completed. It is expected to open the system for public service on July 9th.—*Review of the River Plate.*

Belfast.—The work in connection with the extension of the tramways was begun on the 17th inst., by the contractors, Messrs. Dick, Kerr & Co., London. The first section taken in hand is that which proceeds from the present Ligoniel terminus to Wolfhill, and it is expected that the Donegall Road extension from Shaftesbury Square to Falls Road will be taken up in the course of a few days. Following then will come the extensions on the Oldpark Road, the Ravenhill Road, the Beers Bridge Road and Bloomfield Road, the Castlereagh Road, and Botanic Avenue and University Avenue. The track throughout will be double, and Thermit welded, and the distance covered will be 7 miles. The

contract price is £100,000, and the work is to be completed within six months. The overhead equipment is being carried out by the city electrical engineer. Messrs. Dick, Kerr & Co. are also the contractors for the doubling of the track of the Cavehill and Whitewell tramway.

Birkenhead.—At the Council meeting last week, the Electricity Committee promised a continuance of the amount of £1,500 to the rates, while the Tramways Committee was able to place £2,672 to the renewals fund instead of having to make a draft on the rates, as has been the case in three of the past four years. Since the inception of the undertaking more than ten years ago, the ratepayers have had to find the sum of £4,403 to defray deficits. The traffic receipts for the past year showed an increase of £2,600 over 1910-11.

Bradford.—The City Tramways Department has now publicly announced its intentions as to reduced fares, which after May 1st will be in full operation. Half-penny fares are to be allowed for young workpeople, between the ages of 12 and 16, who are to have special passes which will be issued for use at particular times of the day.

A new tramway brake, which has been invented by Mr. C. J. Spencer, the manager of the city tramways, was shown last week to a deputation from Ayr, who visited the city for a general inspection of the Bradford tramway system. The new brake is one which grips both track and wheel, and is very prompt and effective in operation. The test was made down the Church Bank route, a notoriously steep and awkward track with a dangerous turn at the bottom.

Cardiff.—The tramway men recently passed a resolution threatening to strike unless their demands, including the restoration of the full service, and an allowance for three-quarter time worked during the coal strike, were conceded. They allege that the Corporation saved thousands of pounds on the curtailed service while the men lost wages. The men stopped work on Wednesday, but a limited service is still maintained.

Colwyn Bay.—The deadlock that has existed between the U.D.C. and the Llandudno and Colwyn Bay Electric Railway Co., Ltd., is in a fair way to be removed. It was reported at a meeting of the Colwyn Bay Council on April 16th, that the directors of the Tramways Co. would confer with the Council or a Committee of the Council as to the terms and conditions on which they will extend the electric tramway from the present terminus at Colwyn Bay to Old Colwyn. Mr. T. E. Purdy assumed the Council would adhere to the terms which it had previously as a Council decided to require the company to enter into.

Continental Notes.—France.—The line of railway from Luchon to Montréjeau is shortly to be converted to electric traction. According to the engineer of the Compagnie du Midi, electric driving will be established on the portion of the Toulouse-Bayonne line comprised between Montréjeau and Pau and on all the Pyrenean branches thereto dependent, or on about 270 km. of lines at present in working. Preparations are afoot to build two large water-power works, the first producing 21,000 H.P. and the second 20,000 H.P. Single-phase current at a pressure of 15,000 volts will be generated and distributed to five transformer stations for supplying the trains.—*Revue Pratique de l'Electricite.*

Leeds.—The figures of the past year's working of the City tramways undertaking, submitted last week, showed a very large surplus available for the relief of rates, amounting, indeed, to a sum of £61,163, as compared with £51,888 in the previous year. The gross profit, amounting to £197,806, was a record, and an increase of £22,708. The total receipts were £395,320, an increase of £24,919, or 6·72 per cent. An expenditure of only £2,211 was involved in the earning of the extra profit. The total power expenditure was £24,914, being an increase of £1,386, largely due, it is stated, to an additional expenditure on fuel of £600, owing to the coal strike. The number of car-miles run during the year had been 8,527,957, an increase of 219,518, whilst 86,021,943 passengers had been carried, making an increase of 5,215,673. The receipts per mile had averaged 11·125d. The Tramways Committee decided to set aside the sums of £3,823 and £1,764 to wipe out outstanding loan balances on plant at the power station, and to contribute towards capital outlay a sum of £3,421 for a rotary converter and new brakes.

London.—The Central London Railway has decided to discard the mechanical signals at present in use, and has placed a contract with the McKenzie, Holland & Westinghouse Power Signal Co. for the equipment of the whole of the Central London Railway with automatic signalling.

Manchester. — The Tramways Committee of the Corporation has decided to allocate £85,000 towards the relief of the rates. The receipts during the past year amounted to £46,000 above the estimate, and running costs decreased. The large increase was due to some extent to the abnormal weather during the summer. The City Council may ask the Tramways Committee to contribute £100,000, it being stated that a belief is held in some quarters that the department can afford to contribute more than £85,000.

Nelson.—The tramway manager reports that the income during the past year constitutes a record. This is mainly attributable to the fine summer. Instead of the estimated loss of £273, there has been a profit of £998. In regard to railless trolley cars, Mr. Helm reports that it would be unwise to attempt a tramway scheme for the Walverden district, but it would be well worth while to consider the advisability of a railless system, having regard to the fact that those authorities which had installed the system, spoke highly of it as an auxiliary to the tramway undertaking.

New Zealand.—The Municipality of Palmerston intends to place before the ratepayers a proposal to raise a loan of £69,000 for the installation of an overhead electric tramway system. The length of line will be about 5½ miles.

West Hartlepool.—The B. of T., while approving the tramways extension scheme generally, has modified the proposals to the extent of permitting the Elwick Road lines to go only as far as Eldon Grove, and the Hart Lane lines as far as Welbeck Road—the Serpentine Road and Wooler Road portions thus being cut out of the scheme.

TELEGRAPH and TELEPHONE NOTES.

Australia.—An injunction has been granted at the instance of the Maritime Wireless Co., restraining the Australasian Wireless Co. from threatening users of Father Shaw's system (adopted by the Commonwealth Government for the stations at Melbourne and Hobart) with prosecution for infringement of patent rights.

Directive Wireless Telegraphy.—It is reported that the system which Marconi's Wireless Telegraph Co. has been engaged in developing is the Bellini-Tosi Directional System, and that Mr. Bellini has joined the engineering staff of the company. The apparatus, as fitted on the ss. *Mauretania*, is said to have proved highly satisfactory, and the company is now ready to install it on other vessels.

Germany.—A large wireless station is to be erected at Neumünster, near Wilhelmshaven, which will far exceed in power that at Nauen. Three towers, each 150 m. high, will be begun in May, and four similar towers will be added later on.—*Zeit. für Electrotechnik und Maschinenbau.*

Hythe.—The T.C., which so vehemently demanded the removal of the National Telephone Co.'s poles in The Grove a few months ago, has received notice that the Post Office desires to erect telephone poles in the North Road. Thus Amurath an Amurath succeeds.

Marconi Wireless Telegraphy in the U.S.A.—The Marconi Wireless Telegraph Co. has made arrangements with the Marconi Wireless Telegraph Co., of America, to construct for that company a number of long-distance wireless stations, and the two companies have signed a working agreement with the Western Union Telegraph Co. of the State of New York, and with the Great North-Western Telegraph Co. of the Dominion of Canada, which provides that the Marconi companies shall have the full benefit of those companies' landline stations for the receipt and delivery of their messages throughout the United States and Canada upon the most favourable cable rate terms. The agreement provides that the Marconi Co. shall affix a Marconi signboard to all those of the Western Union Co. The Western Union and the Great North-Western Telegraph companies have in all about 25,000 telegraph offices throughout the United States and Canada.

The Marconi companies are about to erect new long-distance wireless stations providing direct communication between New York and London, and preparations are in hand for the construction of a number of stations to give communication with the East from San Francisco to the Hawaiian Islands, the Philippines, China, and probably Japan. The American company's programme further provides for a second long-distance station to be erected in the immediate vicinity of New York to communicate with Cuba, Panama and South American countries.

The shareholders of the Marconi Wireless Telegraph Co., of America, have resolved to increase their capital to $10,000,000 in shares of $5 each.

Post Office Servants.—A Select Committee has been appointed to inquire into the wages and conditions of employment of Post Office servants.

Turkey.—It is reported that the Turkish wireless station at Kelemish has been destroyed by Italian warships.

Wireless at Sea.—We are informed that Mr. Harold Bride, one of the wireless operators on board the *Titanic*, who is, happily, amongst the survivors, and Mr. Harold Cottam, chief operator on the *Carpathia*, were both trained at the British School of Telegraphy, Ltd, Clapham Road, London, S.W.

The confused and contradictory messages regarding the fate of the *Titanic*, which were recorded during the day following the wreck, have attracted universal attention to the subject of wireless communication, especially in the United States, where amateur operators abound. The false reports that the *Titanic's* passengers were all safe, and that she was slowly steaming towards Halifax, in particular, have been ascribed to inaccurate reception by some unauthorised person, who communicated them to the Press. The *Times* correspondent in New York stated that the Department of Justice repudiated the theory of Mr. Marconi, attributing the messages to amateur operators, and was of opinion that they "were sent in a deliberate attempt to postpone knowledge of the wreck

in order to give time for the reinsuring of the *Titanic's* cargo." The White Star line, however, was not accused of being a party to sharp practice of any kind.

A Bill is to be introduced into Congress to regulate the practice of wireless telegraphy in the United States. In this country, of course, there is no possibility of similar trouble, the erection of wireless apparatus having been for years controlled by the Government, which issues licences only sparingly, and after due inquiry. The operators on British ships are required to hold a Post Office certificate of efficiency.

A memorial is to be erected at Godalming to the heroism of Mr. John George Phillips, the chief wireless operator in the *Titanic*, who was a native of the town.

CONTRACTS OPEN and CLOSED.

OPEN.

Ashton-under-Lyne.—May 1st. Two sets of counter-current jet condensing plant with steam-driven pumps, and one natural-draught wooden chimney cooler, for the Borough Electricity Department. See "Official Notices" April 12th.

Australia.—Victoria.—May 1st and 8th. Cable for P.M.G.'s Department.

June 11th.—Electric incandescent lamps, illuminating and switchboard, and silk-covered wire, for the P.M.G.'s Department. See "Official Notices" to-day.

May 6th.—Arc lamp carbons for the Melbourne City Council. See "Official Notices" April 19th.

May 14th.—Telephones, switches, condensers and protectors, for Melbourne. See "Official Notices" March 22nd.

June 4th.—1,000 protectors, galvanised iron wire, galvanised steel wire and sleeves, for the P.M.G.'s Department. See "Official Notices" April 19th.

May 21st.—P.M.G., Melbourne. 30 miles of cable, 24¼ miles of cable, 699 non-polarised relays. See "Official Notices" April 12th.

May 28th.—Deputy P.M.G., Melbourne. 100 tons bronze wire, 262 tons of hard-drawn copper wire, 188,500 copper binders, 11,500 sleeves, and 126,000 copper tapes (Schedule No. 686). Specification can be seen at the Board of Trade Commercial Intelligence Dept.

Deputy P.M.G., Melbourne.—June 4th. 259,500 porcelain and earthenware insulators and batteries.—June 11th. 9⅛ miles of telephone switchboard cable; 1,000,000 paper jointing sleeves; and 252 tons of sulphate of copper.—June 18th. 15½ miles of paper-insulated lead-covered cables.—Apply, High Commissioner in London for Australian Commonwealth.

July 23rd.—P.M.G., Melbourne. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

Queensland.—May 8th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" March 15th.

May 8th.—Telegraph and telephone instruments, switchboards and accessories, measuring instruments and protectors, for the P.M.G.'s Department. See "Official Notices" March 22nd.

Western Australia.—May 8th. Common-battery telephones, for the P.M.G.'s Department. See "Official Notices" March 22nd.

Tasmania.—June 10th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" April 12th.

N.S.W.—Three centrifugal pumps (12,000 gallons per minute), five 350-kw. transformers, A.C. motors, for White Bay power house, for N.S.W. Government Railways and Tramways Department. Electrical Engineer's office, 61, Hunter Street, Sydney.

Bedford.—Electrical plant (100 lights) for the Powage Press, Ltd. See "Official Notices" April 19th.

Birkenhead.—May 27th. Electric light installation at the Union Workhouse, Tranmere, for the B. of G. See "Official Notices" to-day.

Bray (Ireland).—May 7th. One 150-B.H.P. Diesel engine, coupled to a 100-kw. alternator and exciter, and one 7½-ton overhead crane, for the U.D.C. See "Official Notices" April 12th.

Bristol.—May 6th. One 1,000-kw. three-phase to D.C converter, for the Corporation (British manufacture preferred). See "Official Notices" to-day.

Cape Town.—May 9th. For the City Council.

A steam turbine-driven alternator and converter, the turbine to be capable of giving a continuous output of 2,000 K.V.A.
Approximately 24,750 yards of E.H.T. three-phase cable, joint boxes and disconnection pillars.
Green economiser.

Tenders are to be deposited at the City Hall, Cape Town.

May 15th.—Two electric passenger lifts for new Law Courts. Specifications, &c., from District Engineer, Public Works Dept. Deposit £2.—*Board of Trade Journal.*

A copy of the specification may now be seen at the Com. Int. Department of the Board of Trade in London.

Constantinople.—June 15th. Tenders are invited for the establishment of electric tramways in the Asiatic part of the capital. Particulars, in French, from the Minister of Public Works on forwarding the equivalent of 10s. in Turkish money (half of £T).

Dundee.—The T.C. invites tenders for the supply of sub-station converting machinery and extra-high-tension switchgear. Tenders are also invited for demolition of the present buildings on the site and for construction of a sub-station, and for supply of an overhead travelling crane for new sub-station at the docks. Mr. H. Richardson, Corporation Electrical Engineer.

Falkirk.—May 6th. Stores for a year, for the Burgh Electricity Department. See "Official Notices" April 19th.

The Corporation Electricity Committee will receive tenders for the following:—Manhole frames and covers, lubricating oils, ironmongery and tools. Harold Ranson, resident electrical engineer.

Glasgow.—May 10th. Substation switchgear, for the Corporation Electricity Department. See "Official Notices" to-day

Gravesend.—April 29th. Cables, for the Corporation. See "Official Notices" April 19th.

Grimsby.—May 16th. Continuous-current motor-generator with switchboard panel, and an automatic reversible booster with switchgear, for the Corporation. See "Official Notices" to-day.

Heston and Isleworth.—May 8th. 500-kw. steam engine, D.C. generator, balancer, &c., water-tube boiler, chain-grate stoker, pipework, &c., surface condenser, air pump, &c., for the U.D.C. See "Official Notices" April 19th

Hoylake and West Kirby.—May 6th. One Lancashire boiler, with superheater, &c., vertical steam pump and self-acting re-starting injector, for the U.D.C. Electricity Works. See "Official Notices" April 19th.

Lancaster.—Tenders for installation of electric light at the Gregton Institute in Christ Church parish, Lancaster. The Vicar.

Lincoln.—May 6th. One 1,000-H.P. Diesel oil engine, coupled to a continuous current dynamo, or two 500-H.P. Diesel engines, with continuous current dynamos; one 120-kw. motor-generator and one switchboard, for the Corporation. See "Official Notices" April 12th.

London.—Hackney.—May 9th. High and low-tension cables, boxes, frames and covers, troughing, ducts, &c., for the B.C. Electricity Department. See "Official Notices" April 19th.

Islington.—May 1st. Electrical fittings and sundries, for the St. Mary B.G. See "Official Notices" April 19th.

L.C.C.—May 8th. Electrical installation at the Malmesbury Road Central School. See "Official Notices" to-day.

Manchester.—April 30th. 16-26-H.P. four-cylinder motor car suitable for heavy town work. Specification from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Newcastle-on-Tyne.—May 22nd. Turbo-alternator and converting plant, for the Tramways Committee. See "Official Notices" to-day.

Newcastle-under-Lyme.—Extensions and alterations to switchboard, for the Corporation. See "Official Notices" to-day.

New Zealand.—May 1st and July 1st. Public Works Department. Supply of machinery and material for the Lake Coleridge electric power scheme. See this column in our issue of April 12th.

Southampton.—April 27th. Main cables, switchboard panels and electric lighting of the new buildings at Shirley Warren Poor Law Infirmary for the B.G. See "Official Notices" April 19th.

Southend-on-Sea.—Stores for a year, for the Corporation Electricity Department. See "Official Notices" April 12th.

Spain.—May 4th. The municipal authorities of Oviedo are inviting tenders for the concession for the electric lighting of the municipal buildings and also of a part of the town during a period of ten years.

CLOSED.

Australia.—According to the *Australian Mining Standard* the P.M.G.'s Department at Victoria has placed an order for electrically-controlled clocks, required for use in connection with the Telephone Exchange, Lonsdale Street, Melbourne, at £118 with Messrs. Ingram Bros., of Melbourne.

Aylesbury.—The U.D.C. has accepted the tender of Messrs. Mackrill & Sons, of Aylesbury, for electrical work for a year.

France.—The French Post and Telegraph Authorities in Paris have just placed a contract with the company Le Materiel Telephonique, of Paris, for the supply of 100 km. of 28-pair telephone cable, each copper conductor to be insulated by paper tape, and the core enclosed in a lead tubing.

Northampton.—The Corporation has placed with Messrs. E. Bennis & Co., Ltd., a repeat order for mechanical stokers and self-cleaning furnaces for the tramway power station.

Perth.—The Corporation Electricity Committee has accepted the offer of Messrs. Callender's Co., London, at £4,184, for the extension of mains to carry current to the new premises of Messrs. John Dewar & Sons, the new infirmary and other buildings.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

ADMIRALTY : CONTRACT DEPARTMENT.

Lanterns.—Chloride Electrical Storage Co.

WAR OFFICE.

Dynamos, &c.—India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; Electric Construction Co., Ltd.

INDIA OFFICE : STORE DEPARTMENT.

Armatures.—J. Stone & Co.
Carbons and cells.—Siemens Bros. & Co.
Engines, &c.—British Westinghouse Electric, &c., Co.
Insulators.—Bullers, Ltd.
Pipettes.—Chloride Electric Storage Co.

CROWN AGENTS FOR THE COLONIES.

Stay-rods, &c.—Siemens Bros. & Co., Ltd.
Twin-core submarine cable.—Telegraph Construction and Maintenance Co.
Telegraph posts, &c.—Siemens Bros. & Co., Ltd.; Bullers, Ltd.

GENERAL POST OFFICE.

Loading coils.—Western Electric Co., Ltd.
Flexible cords.—London Electric Wire Co. & Smiths, Ltd.
Portable generating sets.—Lancashire Dynamo and Motor Co., Ltd.
Meters.—Automatic Telephone Manufacturing Co., Ltd.
Telephones.—Gent & Co., Ltd.
I.R., V. and C. cable.—Johnson & Phillips, Ltd.; Ward & Goldstone.
Paper-core cable.—Johnson & Phillips, Ltd.; Western Electric Co., Ltd.
S. and C C. cable.—Western Electric Co., Ltd.
Submarine cable.—Henley's Telegraph Works Co., Ltd.
Insulators.—Taylor, Tunnicliff & Co., Ltd.
Lightning protectors, &c.—British L. M. Ericsson Manfg. Co., Ltd.
Copper wire.—British Insulated and Helsby Cables, Ltd.; T. Bolton and Sons, Ltd.; Elliott's Metal Co., Ltd.; R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co.; J. Wilkes, Sons and Mapplebeck, Ltd.
Electric lift at Birmingham Head P.O.—Turner, Atherton & Co., Ltd.
Telephone exchange equipment, Lincoln.—Peel-Connor Telephone Works, Ltd.
Ditto, Sevenoaks.—Western Electric Co., Ltd.

London.—ST. PANCRAS.—The B.C. has accepted the following tenders :—

Sloan Electrical Co., Ltd.—360,000 open-type arc lamp carbons, £568. (14 tenders received with prices ranging from £499 to £901.)
G. Braulik.—18,000 carbons for Oriflame arc lamps, £23.
General Electric Co., Ltd.—6,000 carbons for Angold arc lamps, £13.
W. Geipel & Co.—12,000 carbons for duplex Excello arc lamps, £70; 3,000 carbons for Luna arc lamps, £11; 2,000 carbons for single Excello arc lamps, £13.

The following tenders were received for supplies of cable :—

R. R. Todd	(accepted)	£2,840
Electrical Engineering Co., Ltd.		2,931
Standard Cable Co., Ltd.		3,051
Western Electric Co., Ltd.		3,208
Johnson & Phillips, Ltd.		3,217
British Insulated and Helsby Cables, Ltd.		3,225
Siemens Bros. & Co., Ltd.		3,227
Henley's Telegraph Works Co., Ltd.		3,248
Callender's Cable Co., Ltd.		3,270
W. T. Glover & Co., Ltd.		3,316
Union Cable Co., Ltd.		3,452
Connolly Bros., Ltd.		3,818
Aubert Grenier & Co.		3,961

Mr. Todd's tender is for cable manufactured by Felten & Guilleaume, and the offer is subject to a rise or fall in the price of copper and lead, and is based upon copper at £74 per ton and lead at £16 per ton.

The tender of the General Electric Co. has been accepted, at £132, by the Metropolitan Water Board, for the supply of electrical fittings required in connection with the installation of electric lighting plant at Surbiton station.

The Metropolitan Asylums Board has accepted the tenders of Messrs. W. J. Fryer & Co., at £33 and £63, for the provision of electric charging plant and lighting at the Brook and North-Western Ambulance Stations.

Pontypridd.—Messrs. Siemens Bros. Dynamo Works, Ltd., of Dalston, have obtained the contract for the supply of tantalum and "Wotan" lamps for 12 months to the U.D.C.

Roumania.—Owing to the failure of response to the public invitation to submit tenders, the T.C. of Constantza is negotiating a contract with the firm of Ganz, of Budapesth, for the lighting of the city and suburbs, the plans of which are now under the consideration of the Minister of the Interior.—*Revue Pratique de l'Electricité.*

Southampton.—The B. of G. has accepted the tender of Messrs. H. J. Cash & Co. for carrying out the heating and other work at the Infirmary, which includes alterations and additions to the electric light for the entire scheme; £5,855 is to be expended.

Southend-on-Sea.—The T.C. has accepted the tender of Messrs. J. Brown & Co., of Clydebank, at £66, for 24 driving-wheel tires and 12 axles for tramcars.

The Council has also accepted the tender of Messrs. E. & B. H. Davey, of Southend, at £1,362, for car-shed extensions.

Sunningdale.—Messrs. John Drake & Co., of Sunninghill, have secured the contract for the electric light installation at the Old and New Dormy House.

Swansea.—The T.C. has accepted the tender of the British Thomson-Houston Co., at £9,270, for two B.T.-H. turbo-alternators, with Cole, Marchant & Morley condensing plant.

Swindon.—The T.C. has accepted for the current year the tender of the Reason Manufacturing Co., Ltd., for 3, 5, and 10-ampere electrolytic meters, also for complete installation sets.

Wolverhampton.—The Board of Management of the Wolverhampton and Staffordshire General Hospital have placed their order for the complete electrical installation of the King Edward VII Memorial Wing with the District Electric Co., Ltd., of Wolverhampton.

Woolwich.—The B.C. has decided to extend for a further period of 12 months the contracts with Messrs. Siemens Bros. & Co., Ltd., for the supply of low-tension cables, and with the Oliver Arc Lamp, Ltd., for the supply of 65,000 pairs of 7-mm. and 6·35-mm. yellow flame carbons, and 17,000 pairs of 7-mm. yellow flame A.C. carbons.

FORTHCOMING EVENTS.

Physical Society.—Friday, April 26th. At 5 p.m. At the Imperial College Science, South Kensington. Papers on "The Solution of Network Problems by Determinants," by Mr. R. Appleyard; and "A Method of Measuring Small Inductances," by Mr. S. Butterworth.

Institution of Civil Engineers (Students' Meeting).—Friday, April 26th. At 8 p.m. Lecture on "The Principles and Practice of Accountancy in Relation to Engineering Design and Work," by Mr. T. Frame Thomson.

Junior Institution of Engineers.—Saturday, April 27th. At 3 p.m. Visit to the engineering workshop and laboratory and the electrical laboratory of the Polytechnic, Regent Street, W.

North-East Coast Institution of Engineers and Shipbuilders (Graduate Section).—Saturday, April 27th. At 7.15 p.m. At Bolbec Hall, Newcastle. Paper on "Oil Engines," by Mr. A. T. Thorne.

Royal Society of Arts.—Monday, April 29th. At 8 p.m. Howard Lecture on "Heavy Oil Engines," by Capt. H. Riall Sankey. (Lecture I.)

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, April 30th. At 7.30 p.m. At the University, Manchester. Annual general meeting. Lecture by Dr. R. Thury.

Institution of Civil Engineers.—Tuesday, April 30th. At 8 p.m. Annual General Meeting of Corporate Members.

Royal Institution.—Wednesday, May 1st. At 5 p.m. Annual meeting.

Institution of Electrical Engineers (London).—Thursday, May 2nd. At 8 p.m. Adjourned discussion on "The Causes Preventing the more General Use of Electricity for Domestic Purposes."

Institution of Mechanical Engineers.—Friday, May 3rd. At 8 p.m. Discussion to be resumed by Prof. J. O. Arnold on "The Tenth Report to the Alloys Research Committee on the Alloys of Aluminium and Zinc."

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, April 29th.—"A" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.
Tuesday, April 30th.—"B" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m. Recruit instruction for those not passed out by Adjutant, 7.30 to 10 p.m.
Thursday, May 2nd.—"C" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.
Friday, May 3rd.—"D" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m. Recruit instruction for those not passed out by Adjutant, 7.30 to 10 p.m.
Saturday, May 4th.—Headquarters will be open for regimental business, from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adjt.,
For Officer commanding L.E.E.

Newspapers and the Law of Libel.—The editor of every paper, however technical, the publisher of every book, however dull, is bound to show some fealty to the law of libel. No newspaper man can afford to ignore the existence of this branch of English jurisprudence. Nor can he, as a rule, afford the time to peruse the mighty tomes which contain the last erudite word on the subject. He may, in the course of his journalistic career, have picked up a few smatterings of the law, but it is not easy to recall nice legal distinctions in the early hours of the morning, or to hunt for libels on press day when the printer's devil is knocking at the door for corrected proofs. In practice, the editor must needs trust his contributors in a large measure; and speaking for ourselves, we have found that the trust has seldom, if ever, been misplaced. But where, it may be asked, is the journalist to ascertain the law? Hitherto he has had but little teaching, except in the school of experience, where the fees are high. They take the form of damages for libel. So high are the fees that journalists are about to attempt an invasion of the monopoly. The University Extension Board of the London University, acting in concert with the Council of the Institute of Journalists, have arranged for a course of lectures to journalists on "The Law of Libel," to be delivered at the Institute of Journalists on May 1st, 8th, 15th, 22nd, and June 5th. The lecturer is W. Valentine Ball, barrister-at-law. The lectures are to deal with libels generally; construction and truth of libels; explanation of fair comment; privilege; practical hints on reporting, &c.; the statutory protection of newspapers, criminal libels, &c.

ELECTRICAL EXHIBITION, OLYMPIA, 1911

The report of the Finance Committee of this Exhibition has issued its balance-sheet, which shows a balance of £10,940 divisible between International Trade Exhibitions, Ltd., and the B.E.A.M.A. This amount has been disposed of as follows:—

International Trade Exhibitions, Ltd., 40%		= £4,376	
Less 5 % rebate to members of B.E.A.M.A.		229	
			£4,146
B.E.A.M.A., 60 % of profit		= £6,564	
Less commission to secretary ...	£328		
Rebate to exhibitors	£2,340		
„ to B.E.A.M.A. members	£459	£3,127	£3,437
			£7,583

The details of income and expenditure are as under:—

EXPENDITURE.

Rent of Olympia and offices	£2,123
General expenses	943
Postage	120
Stationery and printing	223
Catalogue	205
Advertising	1,393
Decorations	557
Entertainments...	301
Electricity	3,205
Insurance	57
Legal expenses	30
Travelling expenses	69
Stand fittings	56
Secretary's salary	200
Bank charges	2
Audit fee	16
Balance carried down, divisible:—International Trade Exhibitions, Ltd., 40 per cent., £4,376; British Electrical and Allied Manufacturers' Association, 60 per cent., £6,564 = ...	10,940
	£20,439

INCOME.

Space rentals	£11,897
Gate money, £2,157; Tickets sold, £2,118 =	4,275
Catalogues and programmes	457
Sale of electricity, gas and water	3,371
Automatic machines receipts...	30
Lavatory and photographic concessions ...	90
Commissions, &c.	202
Bank interest	100
Discount	17
	£20,439

The report accompanying the above accounts makes the following comparison of the accounts of the Olympia Exhibitions of 1905 and 1911:—Rent in 1911 cost £670 more, and the Association had no income from refreshments. General expenses in 1911 were lower by £245. Stationery and printing in 1911 were lower by £356. The catalogue cost was £208 less. Advertising cost £327 more in 1911 owing to display of posters. Entertainments, banquets, band, &c., show a saving of £697. Travelling expenses and commission were less by £291.

In regard to income:—Space rentals were better by £3,172 in 1911. Gate money and tickets were better by £1,083. Donations were £1,480 less, there being none in 1911. Catalogues and advertisements in same produced £152 less. Lavatory and photographic concessions improved by £60, and bank interest by £73.

The supply of electricity to exhibitors showed a loss of £2,000 in 1905, and only S.P., A.C., was available. In 1911 all kinds of supply were available, and though the price paid for current to the proprietors of Olympia was 50 per cent. more, both ends have been made to meet in respect of this item.

The organising managers, in a statement issued by them, show that the economies effected in expenses (primarily under their control) are considerably greater than the accounts show, for the increased extent of the Exhibition, as compared with that of 1905, would have implied a proportionate *increase* on that year's figures.

Electric Lamp Frauds.—At the High Court of Justiciary, Edinburgh, last week, a man named William Taylor pleaded guilty to two charges of having obtained by fraud 100 and 41 electric lamps from an Edinburgh firm and a Coatbridge firm respectively, and of having attempted to obtain in a similar way 78 electric lamps from a firm in Glasgow. It was pointed out that prisoner had been employed by different firms of electrical engineers. Lord Cullen repeated Taylor's last sentence of five years' penal servitude.

Football.—Kirkcaldy and Dundee tramway men played a football match last week, when the Fife men won by 3 goals to 1.

Our report of the German tour of the Football Section of the Osram and Robertson electric lamp works social club is held over until next week.

NOTES.

Dinner to the Engineer-in-Chief of the Post Office.—The engineer-in-chief to the Post Office, Mr. W. Slingo, was entertained by his former students on Saturday last, at the Connaught Rooms, Kingsway, London. The company present, numbering 140, had gathered from all parts of the country to do honour to the founder and principal of what was, in the zenith of its career, the largest and most successful school of its kind in the kingdom. The Telegraphists' School of Science was founded by Mr. Slingo in 1876 with only five students; its membership steadily rose until no fewer than 850 students were upon its rolls, when it had to be broken up and its members transferred to the various technical institutions which had in the meantime been formed. The Telegraphists' School of Science can claim to have been practically the pioneer of that branch of science which has developed perhaps more rapidly than any other within the past quarter of a century. Congratulatory telegrams were received from various parts of the world during the evening.

Mr. G. F. Mansbridge, who occupied the chair, after the usual loyal toast, proposed the health of the "Guest of the Evening." He said that on behalf of the assembled company of ex-students of the School of Science, he offered the very heartiest and most cordial welcome to their old friend, colleague and mentor. Their regard and esteem for Mr. Slingo had always been great, but as the years slipped by they learned to appreciate him still more, and understood more fully how great was the debt of gratitude they owed to him. His appointment to the highest engineering position in the Post Office was, therefore, a source of intense gratification to his old students and assistants.

Mr. MacEwan dealt in an interesting and humorous way with the early career of his able colleague, now engineer-in-chief, and Mr. A. W. Martin said that any progress he might have made had its origin in the great encouragement and kindly advice given him at an early age by their honoured guest; many, or all of them, had had opportunities of hearing most of the famous lecturers, but so far as his experience went, not one of them excelled him as a teacher able to show men "how to think"; to do which should be one of any teacher's highest aims. This ability by no means ceased when the Telegraphists' School of Science passed from his able charge; for all who now came in contact with him in their daily work could still learn from him the way to think. There was no man more willing to place his knowledge at the disposal of others.

Mr. J. Newlands, C.I.E., paid a high tribute to the value of technical education for those who desired to advance in the service, and Miss E. Bennett expressed her indebtedness to the Telegraphists' School of Science for opening its doors to the section of the staff she represented.

Mr. H. A. Miles, in supporting the toast, expressed the hope that their one-time Professor might remain with them as engineer-in-chief sufficiently long to add still further lustre to his name, a name which would be remembered in the annals of the Post Office as that of a chief who was one of his staff, who had personally trained his staff, who climbed from the foot of the ladder to the topmost rung by sheer merit and dogged perseverance alone, unaided by any backstairs influence, and without even the hypothetical advantages supposed to be conferred by a 'varsity education.

Mr. Brooker said Mr. Slingo had not climbed into his office by trading on other men, but had got there by straightforward, hard work, the greatest compliment that he could pay him. In scientific telegraphy he had made a revolution in the present mode of life to-day.

After the various supporting speeches the chairman, in concluding his address, pointed out that the general *motif* of the remarks of all the speakers was the kind of spirit of human nature which distinguished the character of their guest, and he believed it was this, quite as much as his high technical attainments, which had raised him so high in their esteem. The toast was received with great enthusiasm, and was accompanied by musical honours.

Mr. Slingo, in responding, said that he was deeply touched by the way in which the assembly had been called together, as well as by the very cordial manner in which the toast had been proposed and supported by the several speakers. He did not think that it would diminish, in any way, the compliment to himself if he regarded the meeting as an indication of the satisfaction which the C.T.O. had experienced in his appointment. He was very glad to notice that no fewer than 96 old students of the Telegraphists' School of Science were at present holding important positions in the engineering department, that a number of others were similarly situated in the stores and factories departments, and a few were in the secretary's office, the surveyors' department, and the London Telephone Service. So far as the C.T.O. was concerned, the controlling staff was, with very few exceptions, composed of old students. He was very sorry that the school had been closed, for had his proposal that it should be carried on officially been adopted, there would not now have been any dearth of capable engineering officers, nor would it have been necessary to invite the assistance of the universities. He was not without hope that the work would be taken up where he left off, and carried to a proper and natural culmination.

Mr. F. L. Henley proposed "The Chairman," who, in his reply, thanked those associated with him in carrying out the successful re-union.

An excellent musical programme was provided by Mr. Willie Rouse, assisted by Miss Emilie Hayes and Mr. Stanley Holloway. The evening was brought to a close by the singing of "Auld Lang Syne," in which the whole of the company joined.

Educational Notes. — Goldsmith's College, New Cross, S.E.—A number of short evening courses in engineering and building subjects, including a course of eight lectures on electric traction, are to be held during May and June. Particulars may be obtained from Mr. W. Loring, Warden of the College.

Crystal Palace School of Practical Engineering.—The new course commences on Wednesday, May 1st. See our advertisement pages to-day.

The Summer Term at University College in the Faculty of Engineering begins on Tuesday, April 30th. On May 10th at 5.30 p.m. Mr. Leslie Robertson will deliver a public lecture on "The Importance of the Business Side of Engineering," at University College. Mr. A. H. Barker will begin again his lectures on "Heating and Ventilating Engineering," on Wednesday, May 1st, at 7 p.m. Particulars can be obtained from the Secretary of University College.

Social Events.—The first annual dinner in connection with the Aberdare Electricity and Destructor Works was held at the Boot Hotel, Aberdare, on 12th inst. The chief engineer and manager (Mr. A. J. Abraham) presided, and amongst others present were the chairmen of the Council and the Electricity Committee respectively. The aforesaid chairmen both responded to a toast. The chairman of the Electricity Committee referred to the public electric lighting, and stated that the town was obtaining three times as much light as it formerly had with gas, and yet it saved as much as £1 1s. per annum per lamp post. During the recent coal strike the department had not been put to the slightest inconvenience; the normal supply of electricity could be maintained for an almost unlimited period, as the energy was generated by steam obtained from the destructor department. A vote of thanks proposed by Mr. G. F. Soars, of the B.T.-H. Co., was accorded to Mr. W. T. Hilder, mains superintendent, for presiding at the piano, and Mr. G. D. Morgan, commercial assistant, was also thanked for making all arrangements for the dinner, he having acted as hon. secretary and treasurer.

On Monday, the L.C.C. Tramways Electrical Staff held a smoking concert at Anderton's Hotel; there were between 40 and 50 present, and Mr. J. Shepherd was in the chair, supported by the following officials: Mr. Thorn, Mr. Good, Mr. Perry (Northern Section), and Mr. Thomas (Southern Section). Mr. Pope would have been present if possible. The success of the evening was greatly due to the Misses Lock, who both had many encores. The gathering terminated with a hearty vote of thanks to the chairman (Mr. Shepherd), proposed by Mr. Thorn, and due thanks were tendered to Mr. Jones (North Side), for the able manner in which he had got up the entertainment.

Copper.—The consumption of copper, as set forth in Messrs. H. R. Merton's statistical circular, is one of the most encouraging signs of trade revival to be found. In spite of the apparently universal idea that limitation of output leads to increase of input, the consumption of copper for the past half month is sufficient to indicate a healthy determination to keep some industries open, in the face of the logical conclusion of the above doctrine. The withdrawal from stocks during the half month has been 741 tons. The decrease is mostly under "Afloat from Chile," and a less quantity from Australia, Liverpool and Swansea also losing a certain amount. France increases her stock by 73 tons. Rotterdam has dropped 250 tons, to 3,050 tons; Hamburg is estimated to have remained stationary at 7,600 tons. The detailed returns show supplies from North America to England and Havre just average; to other European ports one-third below. From Spain and Portugal England received rather less than one-third the average quantity, but at a rate considerably higher than for last month. Shipments from Chile are above average, from Australia about one-tenth below. Total deliveries are 18,616 tons, a quantity which, if doubled, will be equal to the deliveries for last June or September, only one of which was directly affected by strikes.

The stock in American producers' hands for the end of March was 27,843 tons, a decrease of 255 tons only on the preceding return. The combined visible supply for the end of March is 78,018 tons (excluding Holland and Germany). Since American visible supplies began to fall steadily—*i.e.*, since May last, the quantity has been reduced by 46,262 tons, an average of 4,626 tons per month. A very large withdrawal was made in January last, but February only withdrew 1,491 tons, and March, as above, 255. The world's stocks have decreased 76,574 tons since March 31st, 1911, or at the rate of 6,380 tons per month. Stocks in England and France decreased in the same period 32,092 tons, or an average withdrawal of 2,674 tons per month. At the present rate, therefore, England and her neighbour have 18 months' stock in hand. The revival of trade which would follow a renewed sense of security in industrial conditions would probably increase this considerably.

Engineering Trades Agreement.—The *Times* reports that in the hope of preventing stoppages of work in shipyards and engineering establishments owing to disputes between workmen arising from claims to do certain classes of work, an agreement to be known as the Demarcation Agreement, 1912, has been drawn up between the Shipbuilding Employers' Federation, the Engineering Employers' Federation, and the Shipbuilding and Engineering Trades Federation, to which 20 of the trade unions in the engineering industry are affiliated. A ballot is now being taken. The agreement, which is to come into force on July 1st, in the districts of Aberdeen, Dundee, East of Scotland, Clyde, Tyne, Wear, Tees and Hartlepool, Barrow, Liverpool, Birkenhead and Hull, provides that there shall be no stoppage of work nor shall men be paid off in consequence of disputes on demarcation questions.

The "Daily Mirror" on Haulage in Mines.—A remarkable statement was made in the *Daily Mirror* of April 15th, in the course of an article on the use of ponies in pits—namely, that "England, for some extraordinary reason, is one of the few countries where mechanical traction does not exist. The law rigorously forbids the use of electricity or petrol in mines." The paper had previously asked why it was that "no mechanical contrivance had ever been devised or utilised for hauling the coal trucks about the dark corridors underground." To our readers the utter absurdity of these passages is too obvious to need pointing out. It is unfortunate that writers on the daily Press do not take the trouble to ascertain the facts before they tackle a technical subject, instead of madly charging windmills which to them appear to be giants. Clearly, the writer in the *Mirror* is unaware that the use of mechanical haulage—usually with electric power—has attained to a very high degree of development and extended adoption in British coal mines, and has been common practice for very many years.

The Batti-Wallahs' Society.—This Society held its last smoking concert for this winter at the Holborn Restaurant on Friday last. A representative muster of members turned up, and a very enjoyable evening was spent. The artistes, as usual, were provided by Mr. Harry Heap, under the direction of the hon. entertainment secretary, Mr. Robinson. The president, Mr. F. J. Collis, who was in the chair, suggested that a collection should be made in aid of the widows and orphans of those lost in the *Titanic*, the result of which was some £7 1s. The last of the informal evenings was to be held on the 24th inst., taking the form of a dinner at the Victoria Mansions Restaurant, followed by an amateur concert.

20,000-Volt Shock.—The *Cape Times* Johannesburg correspondent states that, on April 2nd, an electrician had a shock at 20,000 volts, and was not killed. "His name is Ernest J. Horack, and the accident occurred at the Robinson Deep Mine. His hand came in contact with a wire carrying the above voltage, and he was flung to the ground in great agony, being a mass of burns from head to foot. He is now in hospital, conscious, but in a critical condition."

Revised Russian Lamp Duties.—A Bill has recently been introduced into the Russian Duma which proposes to increase the duties on incandescent electric lamps with *metallic* filaments to 65 roubles per poud (3s. 9½d. per lb.) if mounted, and to 90 roubles per poud (5s. 3d. per lb.) if unmounted. The duties at present levied under Sec. 169 (3) of the Russian Customs Tariff on incandescent electric lamps (30 roubles per poud if mounted and 60 roubles if without mounting) are to be retained in the case of incandescent electric lamps with *carbon* filaments.—*Board of Trade Journal.*

Institution and Lecture Notes.—Royal Society of Arts.—A short course of four lectures on "Heavy Oil Engines," by Captain H. Riall Sankey, R.E. (ret.), M.Inst.C.E., will be given before this Society, under the Howard Bequest, commencing on Monday evening, 29th inst., at 8 p.m. The following is a syllabus of the lectures:—

Lecture 1.—April 29th.—The oil engine is an internal combustion engine—Difference between light and heavy oil engines—Difference between Diesel and other heavy oil engines—Brief history of the Diesel engine—Theoretical thermal efficiency—Heat and other losses—Actual thermal efficiency—Efficiency ratio—Thermal efficiency compared with other internal combustion engines and with external combustion engines—Cycle of operation of a four-stroke and of a two-stroke Diesel engine, and essential parts to produce these cycles.

Lecture 2.—May 6th.—Various types of Diesel engines—Considerations affecting design—Design of various parts, such as cylinders, valves, pistons, connecting rods, crank-shafts, frames, air compressors, &c., for four-cycle and for two-cycle engines—Materials used for the various parts—Number and arrangement of cylinders for vertical and horizontal engines.

Lecture 3.—May 13th.—Description of Diesel engines manufactured by various makers—Sizes in current manufacture and future possibilities—Speeds and weight for land and marine engines—Various kinds of oil available for Diesel engines; their characteristics, calorific value, and sources of supply.

Lecture 4.—May 20th.—Economical results in respect of fuel and of total annual cost—Comparison of Diesel, gas and steam engines, in respect of capital cost, fuel cost, and total annual cost—Various applications to land and marine purposes—Other heavy oil engines—Semi-Diesel engines.

Admission to the lectures is free to non-members of the Society on production of a member's order, or by the personal introduction of a member.

The Cold Storage and Ice Association.—Mr. J. T. Milton, the Chief Engineer Surveyor of Lloyd's Register of British and Foreign Shipping, has been elected president of this Association, for the year ending March 25th, 1913. The thirteenth anniversary dinner of the Association will be held at the Hotel Cecil on Monday, May 13th, when the guests of the evening will include Sir Richard Solomon, K.C.B., K.C.M.G., the High Commissioner for the Union of South Africa, and Sir J. Alfred Ewing, K.C.B., Director of Naval Education.

Tramways and Light Railways Association.—The annual congress will be held at Swansea on June 26th to 28th, the headquarters of the Association being at the Langland Bay Hotel, Mumbles.

Institution of Electrical Engineers (Dublin Local Section).—A conversazione was held at Leinster House on Saturday last, the guests being received by the chairman, Mr. S. L. R. Price, and Committee. An excellent musical programme was provided, and the function was much enjoyed.

Appointments Vacant.—Shift engineer, for the Neath R.D.C. (25s.); switchboard attendant, for the Stretford U.D.C. electricity works (20s.); electrical engineer, for a Mexican power plant (£350—£400); Permanent and general assistant, for the Bexley Council Tramways (35s. to 45s.). See our advertisement pages to-day.

Large Turbo-Dynamos.—The largest turbo-generator yet placed in service is the 15,000-KW., 6,600-volt, 750-R.P.M. unit (one of three such ordered from the General Electric Co., U.S.A.), which has replaced a number of 3,500-KW. reciprocating-engine sets in the Water-side station of the New York Edison Co. This machine has been in satisfactory operation since last November. A six-stage Curtis turbine is supplied with steam at 180 lb. per sq. in. and 55° C. superheat; exhausting to a vacuum of 724 mm. (95 per cent.), the steam consumptions at various loads are:—

Load in KW.	10,000	15,000	20,000
Kg. steam per KW.-hour	6·81	6·54	6·81

The machine is mounted 10 ft. above the level of the vault floor, and occupying a floor space of about 17 ft. 3 in. × 16 ft. 9 in., stands 35 ft. 3 in. high overall. The heaviest single piece of the machine weighs 110 tons; the rotor weighs 108 tons, and the total weight is 415 tons. The old reciprocating engine sets occupied 890 sq. ft., as against 288 sq. ft. occupied by the turbo-set, which thus yields about 18 times greater output on a floor space basis. The turbine runners are 3·9 m. in diameter, and the number of blades is 7,200, while the various consumptions per 24 hours on full load are:—7,180,000 lb. steam; 395 tons coal; 5,000,000 gallons of circulating water; 115,000,000 cb. ft. of ventilating air (*i.e.*, 80,000 cb. ft. per minute).

Inquiry.—A correspondent is inquiring for the makers of the "Uniflux" reflector.

The Electrical Trades Benevolent Institution.—The annual Festival Dinner was held on Wednesday evening. The President, Mr. S. Z. de Ferranti, was in the chair, and there were nearly 100 present. During the evening annual subscriptions were promised amounting to £182 10s. 6d., and donations amounting to £249 18s. 6d., a total of £432 9s. Last year the total was £258 17s. 6d. Our report of the function will appear in our next issue.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements*

Central Station Officials.—MR. H. H. DENTON, the borough electrical engineer, Crewe, has, on the occasion of his marriage, which took place on April 18th, been the recipient of a case of cutlery from the officials of the Crewe Corporation. The presentation was made by the town clerk, Mr. H. S. K. Feltham, during a smoking concert held at the Imperial Hotel under the auspices of the Crewe Municipal Officers' Guild. Mr. Denton has also been presented with a smoking cabinet by the electricity works staff and employés, the presentation being made by Mr. J. Hooley, chief assistant engineer.

An Australian contemporary states that MR. H. J. SPENCER, electrical engineer, Redfern, N.S.W., has returned to the position he previously held as electrical engineer with the Hobart Gas Co., Tasmania.

Tramway Officials.—The Tramway Committee of the Doncaster T.C. has appointed MR. A. M. STRACHAN, of Dundee, as traffic superintendent. Mr. Strachan has held a similar position at Dundee for three years. There were over 90 applicants.

General.—The marriage took place at St. Augustine's Church, Preston Park, Brighton, on April 18th, of MR. HARRY HOLLIDAY, A.M.I.E.E., of Torquay, and Miss Gladys M. Hamilton Durn, daughter of Mr. E. Durn, of 5, Beaconsfield Villas, Brighton.

A Cape Town correspondent informs us that MR. JOHN DENHAM, who was for many years Government electrician and railway electrical engineer to the Cape Government, leaves very shortly for England by the East Coast route on a six months' holiday. On his return Mr. Denham will take up his new duties under the Union Government as inspector of machinery on the Rand.

MR. SHERARD COWPER-COLES informs us that he severed his connection some time ago with the Cowper-Coles Galvanising Syndicate, and that he is in no way connected with the Magnet Galvanising & Plating Co., Ltd., which has been formed to acquire the business of the Cowper-Coles Galvanising Co., Ltd.

The *Australian Mining and Engineering Review* states that MR. LASCELLES PARRINGTON, late Victorian manager for the electric light department of the Welsbach Co., has resigned that position, with a view to practising as a consulting electrical engineer.

COL. SIR HERBERT JEKYLL, R.E., K.C.M.G., has been elected a director of the Underground Electric Railways Co., of London, Ltd.

MR. F. DOUGLAS WATSON, the general manager and secretary of the Constantinople Telephone Co., arrived in England last week and will be returning to Constantinople in about a fortnight's time.

MR. ARTHUR W. SPEAR, for many years connected with the Edison & Swan United Electric Light Co., Ltd., has now joined the staff of Messrs. W. & R. Jacobs, specialists in glass shades and electrical novelties and general electrical accessories, being their resident representative for the North and Midlands.

With reference to a "Personal" note appearing on page 344 of our issue of March 1st, a Cape Town correspondent states that the latter part of the paragraph is not correct. He continues:—

"There is still a Local Section of the Institution of Electrical Engineers at Cape Town, and the new officers are:—Chairman, W. F. Long; vice-chairman, W. Hudson; and the following Committee:—Dr. Beattie, A. G. Simpson, A. Vaux, with Prof. Bohle as hon. secretary; and Mr. Pickering as hon. local secretary to the Institution."

MR. G. E. WRIGHT, chief electrical engineer to the North-Western Railway, India, is at present in this country on leave. His address, for correspondence only, is "Longstone," Shalford, near Guildford.

Obituary.—The death took place at Leeds on April 15th, after a short illness, of MR. ROBERT HUDSON, who was well known in electrical engineering circles in Yorkshire. In 1892 he became one of the directors of the House-to-House Electricity Co., which was the forerunner of the present municipal electricity undertaking at Leeds, and which was taken over by the Corporation six years later. Afterwards he joined the board of the Yorkshire Electric Power Co., Ltd., a position he retained until his demise. Mr. Hudson, who was in his 73rd year, was the founder and head of the firm of Robert Hudson & Sons, engineers, of the Gildersome Foundry, Morley.

Among the passengers who lost their lives in the *Titanic* disaster was Mr. B. Case, managing director of the Vacuum Oil Co., Ltd., who came to England from the States in 1886, in the interests of the company. Returning to America in 1891, he came once more to England in 1899, since when he has had control of the company's interests. He was 48 years of age.

NEW COMPANIES REGISTERED.

Automatic Manufacturing Co., Ltd. (121,352).—This company was registered on April 11th, with a capital of £50 in £1 shares, to carry on the business of owners of patents and inventions, contractors for electric lighting, advertising agents, &c. The subscribers (with five shares each) are:—J. E. Olvis, 139, Edgware Road, W., engineer; E. Granville-James, 27, Queen Victoria Street, E.C., secretary. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification, £25; remuneration, £25 each per annum (chairman, £35). Registered office, 27, Queen Victoria Street, E.C.

Electric Marine Propulsion Co., Ltd. (8,209).—This company was registered in Edinburgh on April 4th, with a capital of £60,000 in £1 shares, to acquire the interests of Mavor & Coulson, Ltd., engineers and electricians, Glasgow, in inventions for applying electricity to ship propulsion. The subscribers (with one preference share each) are:—H. A. Mavor, 8, Windsor Circus, Glasgow, engineer; W. C. Warden, 66, Gordon Street, Glasgow, merchant; R. Robertson, 154, West George Street, Glasgow, civil engineer; W. A. Coulson, 47, King Street, Mile End, Glasgow, electrical engineer; G. T. Beilby, 11, University Gardens, Glasgow; Lord Inverclyde, of Wemyss Castle; G. S. Hunter, Wallsend-on-Tyne, shipbuilder; S. Mavor, 47, Broad Street, Mile End, Glasgow, engineer. The first directors (to number three) are to be elected by the preference shareholders; qualification, 100 shares. Registered by John Oswald & Sons, Edinburgh.

Electro-Chemical Developments, Ltd. (121,504).—This company was registered on April 19th, with a capital of £20,000 in 19,000 ordinary shares of £1 each and 20,000 deferred shares of 1s. each, to carry on the business indicated by the title. The subscribers (with one share each) are:—R. B. Cannings, 36, Lausanne Road, Peckham, S.E., clerk; G. Rowson, 17, Chapel Street, N.W., clerk; A. W. Read, 11, Ironmonger Lane, E.C., solicitor; P. Rowson, 17, Chapel Street, N.W., clerk; G. W. Lomax, 25, Moore Street, W., clerk; W. H. Brown, 5, Shouldham Street, W., clerk; J. R. Pakeman, 11, Ironmonger Lane, E.C., solicitor. Minimum cash subscription seven shares. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first. Remuneration as fixed by the company. Registered by Pakeman, Son & Read, 11, Ironmonger Lane, E.C.

"Safetee" Controlling Appliances Co., Ltd. (121,392).—This company was registered on April 12th, with a capital of £7,000 in £1 shares (5,000 preference), to take over the business carried on at Langley Street, Luton, by A. L. Weekes, as the "Safetee Controlling Appliances Co.," and to carry on the business of manufacturers of electrical controlling gear, switch fuses, cooking, heating and domestic appliances, motor starters and regulators, &c., and to adopt an agreement with A. L. Weekes. The subscribers (with one preference share each) are:—Mrs. A. M. Weekes, Brooklands, Lansdowne Road, Luton, Beds.; W. J. Coom, 195, Castle Street, Luton, Beds., secretary; A. E. Ralph, 36, Conway Road, Luton, Beds., engineer. Private company. A. L. Weekes is the first directors; qualification, £100. Secretary (*pro tem.*): A. E. Ralph. Registered by T. Cannon Brookes, Norfolk House, Norfolk Street, W.C.

CITY NOTES.

Hastings and District Electric Tramways Co., Ltd.

THE directors' report for the year ended December, 1911, includes the revenue account of the statutory company for the same period, with the corresponding figures for 1910. The latter account shows that there has been an increase in the traffic receipts of £650. The expenditure side of the account shows a net increase of £1,[illegible], principally due to the cost of upkeep of permanent way, and to the payment of increased wayleaves to the Corporation of Hastings. The revenue account, after crediting receipts aggregating £21,018 and debiting administration expenses amounting to £1,386, shows a balance of £19,632, plus £1,849 brought forward. Deducting £10,504 for interest charges, there remains an available sum of

£10,977. Out of this an interim dividend of 3 per cent. on the preference shares was distributed in October last, and it is now proposed to pay a final dividend of 3 per cent., making the full 6 per cent. for the year. From the balance of £6,177 then remaining the directors propose to transfer £4,000 to depreciation account, making the total of that account £24,000, and to carry forward £2,177. The balance-sheet gives effect to the scheme of arrangement approved by the shareholders in April last, and subsequently confirmed by the Court.

The annual meeting was held on Tuesday at the offices 1, Queen Victoria Street, E.C. Mr. George Kitchin presided, and said that dealing first with the expenditure, power costs showed a decrease of £361, mainly owing to the saving on fuel, consequent upon the adoption of a new and reliable form of meter, which was installed on all the cars in February, 1911, and which had resulted in an economy in the use of current by the motor men. Traffic expenses showed an increase of £243, principally due to the provision of new uniforms for the staff during the year. Maintenance and repairs had increased by £1,143, occasioned by extra cost incurred in the upkeep of the permanent way. The physical conditions prevailing at Hastings made the efficient maintenance of this part of the system at all times both difficult and expensive; but last year the difficulty was aggravated, as large tracts of the old macadam got simultaneously into a condition requiring renewal. To cope with this and put their track again into first-class order, it became necessary to considerably augment their permanent way staff. The increase under this heading was no less a sum than £1,311. There still remained a good deal of this work to be done, the cost of which would come into this year's accounts; but the effect of this expenditure would make itself felt in improved conditions of running, and, later on, in the reduction of maintenance costs to a normal figure. The increase of £203 in general expenses was principally due to additional payments for wayleaves under their agreement with the Corporation of Hastings. This agreement provided that such payments—in respect of some of the lines—should be increased after they had been worked for five years; the idea apparently having been to give the company time to develop its traffic and place its capital on a dividend-paying basis. When the period of five years was expiring, they wrote to the Corporation pointing out that the company, owing to various causes outside its control, had not been able to establish itself upon this footing, and asking that the increased charge might be deferred for, say, a further period of five years; but, he regretted to say that the Corporation, without giving any reason, declined to accede to their request. The receipts showed an increase of £732, of which £630 was due to improved traffic. Although the weather conditions were generally excellent, the effect was neutralised to a large extent by the railway strike, which was in progress during the time when their receipts should have been largest. The result for the year was an available balance of £10,977, which after allowing for the full dividend of 6 per cent. on the preference shares, and the allocation of £4,000 to depreciation, bringing that account up to a total of £24,000, left £2,177 to be carried forward. During the year the scheme for reconstruction sanctioned by the shareholders was passed by the Court, and the balance-sheet had been remodelled in accordance with that arrangement, unrealisable assets having been written off to the amount of £127,057. The directors congratulated the shareholders in having now what might be described as a clean balance-sheet, a depreciation fund which was gradually assuming its right proportions, and a reasonable prospect of the regular payment of at least the preference dividend. As regarded the current year's operations, the coal strike had affected them in common with all the transport companies, having necessitated their running a modified service as from March 20th. They managed, however, to run the full service during the four days of the Easter holidays, but owing to the curtailment of the railway services the result compared unfavourably with that for the corresponding days of last year. The branch of their line that ran from Bexhill to Cooden Bay had always been run at a loss, but it was satisfactory to know that extensive developments were now taking place on Earl de la Warr's estate at Cooden, comprising the laying out of residential building plots, the erection of a large hotel, the licence for which had already been granted, the construction of a golf course and tennis courts. All of those would be near to the Cooden terminus of lines, and should eventually make this line a benefit to the company instead of a drawback.

Mr. E. C. Morgan seconded the motion, and the report was adopted.

Callender's Cable and Construction Co., Ltd.

The directors' report states that the accounts for the year ended December 31st, 1911, show a balance at the credit of profit and loss account of £76,835, plus £40,073 brought forward, making together £116,908; from this must be deducted interest on debenture stock £13,500; dividend on preference shares, £10,000; appropriation for depreciation of buildings, plant and machinery, £8,338; written off office furniture, £289; making £32,127, leaving an available balance of £84,781, which it is proposed to deal with in the following manner:—Dividend on the ordinary shares at the rate of 10 per cent. per annum, less income-tax, being 10s. per share, whereof 5s., less income-tax, was paid on November 1st, and 5s., less income-tax, will be paid on May 16th, £17,500; a bonus of 5s. per share, less income-tax, to be paid also on May 16th, £8,750, carrying forward £58,531. The profit for 1911 show a substantial increase, being no less than £20,000 more than those of 1910. The directors consider this result to be highly satisfactory. In spite of many difficulties due to labour unrest, the business of the past year showed a gratifying increase, the employment of electricity (and consequently of cables) having steadily advanced. The company's export business has been extended in many directions, and there has been a large demand for cables both in the overseas trade, and for the Continent, where the use of electricity is expanding at a still more rapid rate than in this country. Since the close of the year now under review, several important foreign contracts have been secured, one order especially, for the City of Tokio in Japan, being of unusual magnitude. The telephone cable department has now been centred at Erith, and is completely installed and running in a satisfactory manner. Important orders have been received from the British Government, from various Colonial authorities, and from abroad. Developments have also taken place in the company's engineering department, resulting in new branches of manufacture being undertaken, producing a larger turnover and better results than in the previous year. In all departments the factory at Erith was fully occupied, especially during the latter part of 1911. This healthy condition of affairs continued into the present year, but for a time less new home business was placed as a result of the interruption to trade in all parts of the country from the unfortunate strike of the miners, which is, however, now happily at an end. Owing to arrangements made in the early months of this year it has been possible, in spite of the strike, to continue the operations of the cable department without any curtailment, and large orders are in hand and in course of manufacture. Some reduction in the running hours of the engineering department has, however, been necessary, but it is expected that at an early date normal conditions will again be resumed in these shops. It is to be regretted that the steadily improving trade in the electrical industry has been interrupted just at the time when prospects were brighter than they have been for many years past. The operations of the Anchor Cable Co., in which this company holds a substantial interest, have again been satisfactory. The turnover has been increased, the scope of the business has been extended in several directions, and the profits realised have been in excess of those of any previous year, the dividend for 1911 having been 15 per cent. As usual, all machinery, plant, and appliances at the factory and on outside contracts at home and abroad, have been maintained in the highest possible state of efficiency, the cost having been debited against the year's profits. The arrangements referred to last year with reference to the Uxbridge and District Electric Supply Co., Ltd., were duly completed, and the results obtained have been fully in accordance with the expectations of the directors. The increase in the volume of foreign business to which reference has been made, has of necessity involved the employment of large sums of money. In order to cope with the situation thus arising, and to obviate the necessity of making a further issue of the capital or debentures, arrangements have been made for the formation of a subsidiary investment company to be called Callender's Share and Investment Trust, Ltd. A sale of a considerable amount of the company's holdings in other undertakings will be made to the new company in exchange for funds to be used in the immediate expansion of the business. Full details of these arrangements will in due course be submitted. An amount of £10,000 hitherto standing in the balance sheet to the credit of a suspense account now disappears; this sum has been written off share investments. A portion of the amount at credit of machinery renewal account has been applied in reduction of patterns. Owing to the extension of the company's business, Mr. Petersen, one of the assistant managers, who has filled the post of acting secretary during the past year, has found it impossible to combine both duties, and the directors have therefore appointed Mr. Walter Allnutt, who has been in the service of the company for several years, to the post of secretary.

Indo-European Telegraph Co., Ltd.

In their report for 1911, the directors remind the shareholders that the company's Persian Concession has already been extended to 1945, and they state that terms have now been agreed both with the Postmaster-General and with the Imperial German Telegraph Administration for a similar extension, which will, they hope, shortly be embodied in formal agreements. The agreement with the Postmaster-General will, it is hoped, include the provision for the company's use of an additional cross-Channel cable wire, which has so long been urgently needed to enable the company to deal effectively with increasing traffic. Negotiations with the Imperial Russian Telegraph Administration with a view to a similar extension of the company's concession from the Russian Government are in active progress, but no definite announcement can be made at present. The company's revenue from message account and other sources, as shown in the revenue account, amounts to £172,427, as compared with £155,549 for 1910, showing an increase of £16,878. The expenses are, on commercial and general account, £55,714, and on maintenance account, £30,372, making a total of £86,087 as against £80,869 for 1910, showing an increase of £5,218. The revenue account, therefore, shows a balance of £86,340, which is carried to profit and loss account, 1911, and after deduction of income-tax paid is reduced to £81,770. To this is added the balance of profit for 1910 brought forward of £11,327, making a total of £93,098. £35,000 has been placed to reserve, and £3,454 has been provided to meet the depreciation of the company's securities to date. Deducting these sums and the interim dividend of £10,625 already paid, there remains a balance available for distribution of £44,019. The directors now

propose to declare a dividend for the six months ending December 31st, 1911, of 17s. 6d. per share (making, with the interim dividend already paid, 6 per cent. for the year) and a bonus of 20s. per share, both free of income-tax, carrying forward £12,144 to the credit of 1912. They also propose to make a special distribution to the shareholders of £12,750, equivalent to 15s. per share, out of interest upon certain investments and advance accounts. This distribution also will be free of income-tax.

Anglo-Portuguese Telephone Co., Ltd.

The directors, in their report for the year ended December, 1911, state that the assets and liabilities in Portugal have been made up at the exchange ruling on that date. Provision has, as usual, been made to safeguard the company from any serious consequences arising from fluctuations in exchange during the current year. The profit and loss account shows a gross revenue of £57,045, of which operating, management and general expenses absorbed £29,884, and royalties to the Portuguese Government, £1,634, leaving a gross profit of £25,526. After providing for debenture interest, £2,278, sinking fund, £1,322, and income-tax, £767, and appropriating £12,500 to the reserve fund, which now amounts to £50,000, the amount available for disposal, including £4,723 brought forward from the previous year, is £13,382. In November last the directors paid an interim dividend of 3 per cent., free of income-tax, amounting to £3,000. They now recommend the proprietors to declare a final dividend of 5 per cent., free of income-tax, making a total distribution of 8 per cent. for the year 1911. This will absorb a further £5,000 and leave £5,382 to be carried forward. As in previous years, the profit and loss account was credited only with the proportion of subscriptions for which the company had actually rendered service during the year. The proportion of the year's subscriptions unearned at December 31st, amounting to £24,229, has been treated in the balance-sheet as a liability of the company. During the year, considerable additions and improvements were made in the company's central offices in Lisbon and Oporto, which have had the effect of improving the service in both places. In order to provide funds for carrying out important contemplated extensions of the company's business, the directors ask the shareholders to authorise the increase of the capital of the company to £150,000.

The twenty-fifth ordinary general meeting of the shareholders of the above company was held on Monday, at 48, Cannon Street, E.C., Mr. Herbert Allen presiding.

The Chairman, in proposing the adoption of the report, said there was an agreeable monotony about the figures which he had referred to on previous occasions. Each year seemed to show an improvement on the profit of its predecessor. There had been a net increase of 233 subscribers in Lisbon and 133 in Oporto, or a total increase of 366. Those increased subscribers had given them an additional gross revenue of £2,654. Having regard to the political conditions which prevailed in Portugal throughout the year, he thought that increase in revenue of nearly £3,000 could not but be regarded as satisfactory. They had succeeded in effecting a reduction of £1,339 in the operating expenses, and he thought he might claim that, as regarded ratio of expenditure to receipts, the company compared very favourably with any similar undertaking. After payment of the royalties and providing for the debenture interest and sinking fund and income tax they had a net profit of £21,160, in comparison with £17,330 for the previous year; or an increase of £3,830. Adding the balance of £4,722 brought into the accounts they had at their disposal a total of £25,882. Of that they had placed £12,500 to the general reserve; the 8 per cent. dividend, free of income-tax, would absorb £8,000, and they carried forward £5,382. The sum placed to reserve was £2,500 in excess of the sum carried to the same account in the previous year, and the carry forward was £660 better. Reverting to the condition of affairs in Portugal, whilst the political changes had not brought about the success which was anticipated in some quarters, and though there was general depression in the business of the country owing to the striving of the opposing political parties, the business of their company had suffered very little, as was proved by the continued growth of subscribers and revenue. Whatever the political situation, the feeling of the board was that the shareholders need have no misgivings as to the future prosperity of the company. The total number of calls over their lines in the year 1911 in Lisbon and Oporto was 14¼ millions, an increase of three million over 1910. The total number of the company's employés was 269. As a result of the recommendations of the managing director after a visit to Portugal, they had made many minor improvements in the service. They had given a good deal of attention to the welfare and comfort of their operators and other members of the staff. He was glad to say that the effects of the strike in 1910 seemed to have entirely disappeared, and their employés were now working quite contentedly. The company had now completed 25 years of its existence, and looking back he was surprised to find what a small beginning it had in 1887. Its gross income for that year was only £4,000 odd, and the profit on working was £1,695. At the present time the gross income was £57,000, and the profit on working had gone up to £25,000 odd. Making another comparison, during the last seven years which dated from the time he became associated with the company as a director, he found that extremely satisfactory progress had been made in that later period. Prior to 1905 the finances of the company were in rather a chaotic condition, but as the outcome of what his colleagues did at that time, they had got the finances on a thoroughly sound footing. Previous to 1905 they had been paying small dividends, varying from 2½ up to 4 or 5 per cent. on a small capital of £51,000. The effect of the re-arrangement of the finances was to increase the share capital to £100,000, besides which they had to issue £50,000 of debenture stock. In the seven years from 1904 to 1911 the gross revenue had grown from £25,000 odd to £57,000 odd, and the net profit had increased from £10,000 odd to £25,000 odd. In the same period they had got the dividend up to 8 per cent., and there they seemed to stick. The present was the third or fourth occasion on which they had paid an 8 per cent. dividend, and there seemed to be a sort of unwritten law that telephone companies should not exceed that dividend. The expenditure last year on capital account was £9,468, which was rather below the average of recent years. Since 1905 they had expended on capital account £66,000 odd, and during that period they had issued neither shares nor debentures; on the contrary, they had reduced the debenture debt by £5,975 out of profits. In the same period they had built up a general reserve fund of £50,000, and they had also formed an exchange fluctuation account of £4,000. As regarded the future, they had had to seriously consider the question of providing further facilities for the Lisbon public. There was only one alternative to enlarging and increasing the capacity of their existing exchange (which could only be done at a very great outlay), and that was to open a second exchange in Lisbon, and that they had practically decided to do. If that proposition was carried into effect they expected that the number of subscribers in the vicinity of the exchange would increase; but quite apart from that, they considered it very desirable that they should have this new exchange. It would lead to an increase in the business, and, he hoped, to a substantial increase in their profits. It would cost a very considerable sum, and they had other prospects in view for the future which could not be borne by revenue, and that was why they proposed to increase the capital of the company.

Mr. Charles Woolley seconded the motion, and the report was adopted.

Subsequently a resolution was unanimously adopted increasing the capital to £150,000 by the creation of 50,000 new shares of £1 each, the Chairman remarking that it depended very largely upon the arrangements which the company came to with the Portuguese Government whether or not the new capital would be issued.

Lancashire Power Construction Co., Ltd.

The directors' report for the year ended December 31st, 1911, says that the company's contract with the Lancashire Electric Power Co. for the extension of their generating station has now been completed; this extension consists of buildings designed to accommodate three generating sets, with a total capacity of about 10,000 kw., together with a first unit of 2,500 kw. and the necessary boilers and other auxiliary plant. The Parliamentary Co., in order to meet increasing demands, has found it necessary to proceed with the installation of a second unit, and the order for the plant, which is to have a normal full-load capacity of 3,500 kw., has been placed with this company. The necessary capital for the above extension was provided by an issue in June last of £50,000 of 5 per cent. prior lien bonds, which issue was fully subscribed. This company's revenue is derived entirely from the Lancashire Electric Power Co., of which they are the sole owners, and the trading profit of that company for 1911 was £10,695. This result is considered satisfactory, after taking into account the labour troubles and railway strike, the effect of which in the manufacturing district of Lancashire has been very keenly felt. The amount standing to the debit of the company's revenue account, after payment of debenture interest, &c., is £7,737, which will, given normal industrial conditions, be written off out of the profits for the current year; if this anticipation is realised the debit balance of £17,194, shown in the company's balance-sheet of 1909, will have been entirely written off out of revenue. From the following comparisons it will be seen that the growth of the company's business during the year 1911 has been well maintained, in spite of the adverse conditions brought about by the unsettled state of the labour market:—

	1909.	1910.	1911.
Units generated	9,251,831	13,646,307	17,771,996
Max. load in kw.	3,320	4,630	5,590
H.P. connected	7,710	10,600	13,600
Receipts	£15,294	£21,952	£32,726
Expenditure	£15,164	£18,467	£22,031
Trading result	£130 Profit	£6,485 Profit	£10,695 Profit

The receipts from the six districts in which the company operates electric lighting orders have shown a marked increase, the actual figures being £468 for 1910, and £1,368 for 1911. The capital expenditure on these six orders amounts to £10,697. Several important contracts came into operation during the year under review, and the demand from collieries and textile works has been particularly encouraging. The new weaving shed referred to in last year's report was completed during the summer of 1911, and the system of driving—viz., a separate motor for each loom—is giving great satisfaction to all concerned. This development has been followed very closely by those interested in the weaving industry, and numerous inquiries in connection with the system adopted have been received by the company. With regard to the present year, the consumption of energy for the first two months has shown a considerable improvement over 1911, and it is confidently anticipated that the rate of increase in the profits will not be less than in 1911; the fact that at the beginning of 1912 over 2,600 H.P. had been contracted for but not yet connected, as against 1,100 H.P. at the beginning of 1911, fully justifies this anticipation. Messrs. T. O. Callender and H. C. Levis, the retiring directors, offer themselves for re-election.

The annual meeting was held on the 18th inst., at Salisbury House, London Wall, E.C., Dr. Parshall, the chairman, presiding.

In proposing the adoption of the above report, the CHAIRMAN said there had been an issue of £50,000 5 per cent. prior lien bonds last June, for the purpose of providing for the extension to the power house. He was glad to say that the extension had been completed under the estimates, and it was working satisfactorily. The money also provided for the large generating unit placed on order to enable them to cope with the new business in sight. The Lancashire Electric Power Co.'s results, and the growth of the business, were fully set out in the report. The growth had taken place, although the general industrial conditions had been greatly disturbed. The profit (£10,695) was somewhat less than they anticipated, owing to the railway strike and other labour conditions having reduced the output during the year below the normal; but, considering all the circumstances, he thought it must be conceded that the result was a satisfactory one. They had gone through the coal strike, and kept up a supply to their customers without raising the price, and they had received many congratulatory letters from satisfied customers. As the shareholders knew, the directors had been trying year after year to get permission to give a supply to Radcliffe, which was adjacent to their power station. There was a large demand for power in that district, but the local authority had an absolute veto, and up to the present they had not been able to get permission to give a general supply. This year the Radcliffe Council applied to the Local Government Board for an additional loan, and the company, as ratepayers, opposed the application on the basis that they could give a supply more economically than the Council, and that if itwere done by the latter it could only be at the expense of the rates. It came out in the inquiry that Radcliffe proposed to take a bulk supply from Bury, and that if the supply were given at the price that would enable Radcliffe to compete with the power supply of their company, Bury would be at a very substantial loss over a period of 10 years. Whether the Local Government Board were going to consent to Radcliffe embarking in the power business at the expense of Bury, remained to be seen.

SIR ROBERT A. HAMPSON seconded the motion, and the report was adopted.

London United Tramways, Ltd.

A MEETING of the first mortgage debenture stock-holders of the above company was held on Friday last at Winchester House, Old Broad Street, E.C., Lord Revelstoke, one of the trustees, presiding. The CHAIRMAN proposed the following resolutions :—

1. That Clause 22 of the said trust deed be varied, so that in addition to the modes of investment authorised by such clause any moneys which, under the trusts of the said deed ought to be invested, may be invested in the names or under the legal control of the trustees in the said first mortgage debenture stock of the company, and that the trustees be, and they are hereby, authorised and empowered to invest any such moneys accordingly, and to execute such supplemental trust deed or other documents, and do all such hings as may be necessary to give effect to this resolution. (2) That the proposal of the company to abandon the existing horse tramway and the powers to construct an electric tramway in Kew Road, Richmond, Surrey, be, and the same is hereby, approved, and that the trustees be authorised to execute and do all such releases, acts and things as they may deem necessary to give effect thereto.

He said the object of the first resolution was to enable the company to invest moneys coming into their hands under the terms of the trust deed, and particularly moneys coming from the L.C.C. in respect of the purchase of certain tramways belonging to the company within the borough of Hammersmith, in the redemption of first mortgage debenture stock, in addition to the other ways which were authorised under the trust deed. He thought it must be a self-evident proposition that such an investment as this by the company in its own debenture stock was beneficial to all parties. The second resolution gave them power to abandon the existing horse tramway and the powers which the company had to construct an electric tramway in Kew Road, Richmond. It was clear that the horse tramways could only be run at a considerable loss, and that the only method by which they could be electrified would not allow of their being a financial success. Under the circumstances, it appeared to him (Lord Revelstoke) and his co-trustee, Sir George White, that it would be in the interests of the debenture stock-holders to sanction the abandonment of a part of the concern which could only be run at a substantial loss.

MR. W. H. BROWN seconded the resolution.

MR. J. CATER SCOTT, chairman of the company, said that the question of the abandonment of the Kew and Richmond tramways was an old one. They had been working it at a loss for a great many years, and had always contemplated that it would be electrified sooner or later. From the first they had seen that the only way in which it could be worked successfully as an electric road was by the trolley system, and even then they had grave doubts as to whether it would be a great success. The Richmond Corporation, however, had insisted that the company should adopt the conduit system, which meant a much heavier cost, under which the line could never be a financial success. Under the circumstances they were going to Parliament to ask them to extend the time for the construction, but that was of very little value because their intention undoubtedly was to abandon the line if they could, and he hoped they might be able to arrange that. They would save money which they were losing every year, and they would get rid of the liability of having to spend a considerable amount in the electrification of the line.

MR. SCOTT, in reply to questions, said that by the award, the L.C.C. was to pay the company £254,000, but the Council was appealing against it on certain points, and it must not be taken that the £254,000 was the amount they would receive. It might be subject to certain deductions. There was no compulsion for holders of the debenture stock to do anything at all. The trustees would buy the stock in the open market from such holders as wished to sell. With regard to extensions, the company at present had no intention of building further tramways; but of course they did not know what might happen in the future. The trustees could not pay the debentures off; they could only buy them in the market.

The resolutions were carried unanimously.

Prospectuses.—*The Hydro-Electric Power and Metallurgical Co., Ltd. (Tasmania).*—Messrs. Parr's Bank, Ltd., have been offering for subscription £145,000 5 per cent. first mortgage 30-year debentures; 70,000 preference shares (5 per cent.) of £1 each have been issued and subscribed for in cash in Australia. The prospectus contained a report by Messrs. Merz & McLellan (consulting engineers to the company), stating that the power available is 85,000 H.P., and that the first portion of the company's development comprises headworks for 40,000 H.P., channels and transmission line for 20,000 H.P., and electrical generating machinery for the first 9,000 H.P. The estimated net profit from 3,000 H.P. is stated to be sufficient to cover the interest on the debentures more than three times over. Within easy transmission distance of the station, power station machinery for 32,000 H.P. is installed, which, it is said, can be advantageously supplied by the company. The construction work commenced last summer, and the weir and channels are now nearing completion. The works are estimated to cost £165,000. The list was to close on Wednesday.

The Mexican Midland Light and Power Co., Ltd.—The list was to close yesterday in the sale of $3,000,000 (£616,438) in 5 per cent. first mortgage 50-year gold bonds at 88 per cent. A bonus of 25 per cent. in fully-paid shares is to be issued to each subscriber upon payment of his final allotment. The company has been formed to acquire the whole of the share capital, one million $1 shares, of a company incorporated in Mexico, under the title of the Compania Hidro-Electrica Mexicana S.A., which has a number of Mexican electrical concessions. Construction contracts have been entered into with the French Thomson-Houston Co. and Messrs. Johnson and Phillips, Ltd., of London, where-under the company expects to be in a position to supply current within 18 months from commencement. The contracts for power stations, plant, transmission lines, &c., for 65,000 H.P. per annum will be £949,181. The proceeds of the present issue, together with the proceeds of $5,000,000 bonds sold in Paris, will amply suffice to provide this sum and to pay interest on the bonds during construction. Mr. J. MacGregor, managing director of Johnson & Phillips, Ltd., is a director of the company.

Compañia Hidro-Eléctrica de Tucuman (Argentina).—This company has been offering £300,000 5 per cent. first mortgage debentures (£100 each), and £100,000 in shares of $100 each. The company was formed in 1910 to supply electric energy in the entire province of Tucuman. The first section, to develop 4,000 H.P., will be completed and put into operation in September next. It is proposed to immediately extend by putting down another power station farther up the river, to provide a further 3,000 H.P., next year. £227,000 had been expended up to January last. The list was to close on Wednesday.

Official Announcements re Companies.—The following companies will, unless cause is shown to the contrary, be struck off the register within three months, and will accordingly be dissolved :—

Birmingham Electrical Case Co., Ltd.
British-Bitumen, Ltd.
Cyclops Asbestos Co. (Liverpool), Ltd.
Durite, Ltd.
General Power Development Co., Ltd.
Hooghly River Electric Power Co., Ltd.
London Electric Hot Air Baths (Greville's System), Ltd.
North-Eastern Electrical Stores, Ltd.
North Lancashire Electrical Treatment Co., Ltd.
Ozonia Co., Ltd.
Pyrenees Electrical Society, Ltd.
Railway and Tramway Development Co., Ltd.
Scandinavian Asbestos Lubricating Co., Ltd.
Universal Electrical Supply, Ltd.
Variable Electric Lamp Syndicate, Ltd.
Werner-Stuart Steam Generator Syndicate, Ltd.
Wireless Telephony (Entertainments) Co., Ltd.

Stock Exchange Notices.—The Committee have appointed special settling days as under :—

Thursday, May 2nd.—Automatic Telephone Manufacturing Co., Ltd.—100,000 ordinary shares of £1 each, fully paid (Nos. 1 to 100,000); and 200,000 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 200,000).

And ordered the undermentioned securities to be quoted in the Official List :—

Automatic Telephone Manufacturing Co., Ltd.—200,000 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 200,000).
Calcutta Electric Supply Corporation, Ltd.—Further issue of 38,012 5 per cent. cumulative preference shares of £5 each fully paid (Nos. 160,371 to 198,382).

Applications have been made to the Committee to allow the following securities to be quoted in the Official List :—

South American Light and Power Co., Ltd.—£150,000 5 per cent. first debentures of £100 each (Nos. 1 to 1,500).

Calcutta Electric Supply Corporation, Ltd.—The directors have decided, subject to audit, to recommend a final dividend on the ordinary shares for the half-year ended December 31st last, at the rate of 10 per cent. per annum, making 8½ per cent. for the year, the same as for 1910.

Victoria Falls and Transvaal Power Co.

The Marquis of Winchester presided on Monday, at Salisbury House, E.C., over an extraordinary general meeting of the above company, for the purpose of considering, and, if thought fit, passing the following resolution :—

"That the directors be, and they are hereby authorised, in addition to the £3,000,000 already borrowed for the purposes of the company, to borrow amounts not exceeding in the aggregate £2,000,000, and to secure the repayment of the sum or sums so borrowed in such manner and upon such terms and conditions in all respects as they think fit."

The Chairman, in moving the resolution, said the shareholders were invited to sanction an increase in the borrowing powers of the company by £2,000,000 in excess of the £3,000,000 which, as they were aware, had been already issued, and the greater part of the proceeds of which was represented by the plant upon the Witwatersrand already in commission, while the balance was required for plant now under construction. They had Simmer Pan and Brakpan for supplying Victoria Falls consumers, and Rosherville and Robinson Central for the supply of the Rand Mines power consumers, all working at their full capacity. By August next the Vereeniging station should be in operation to the extent of 50 per cent. of its present proposed capacity, and the balance should be in commission at the commencement of 1913. The demands of their customers under long-term contracts fully exceeded the capacity of their present stations, including the Vereeniging station. It was proposed to ask the shareholders to consent to the increase in the borrowing powers by £2,000,000, by the creation of £2,000,000 5½ per cent. second debentures, but it was only proposed to issue at the present time £1,000,000. If they sanctioned the borrowing powers asked for, the arrangements for the issue negotiated with certain strong financial groups would be concluded. The provision of these future financial resources would be to add strength to the undertaking, and they were confident the issue would improve the prosperity of the holders of the preference and ordinary stock.

Mr. J. Brakpan seconded the resolution, which was carried without discussion.

Peterborough Electric Traction Co., Ltd.

The directors' report for 1911 states that the total revenue amounted to £6,961, and after deducting expenses chargeable to revenue, £4,568, and debenture interest, £945, the profit was £1,448, plus £52 brought forward. The directors recommended that £750 be allocated as provision for renewals ; preference dividend for the six months ended March 31st, 1909, absorbed £660 ; and £90 is carried forward. The total expenditure on capital account, including preliminary expenditure, has been £62,912. There was an increase in the traffic receipts of £667, as compared with 1910, mainly due to the improved state of trade, also to the opening of the new agricultural show ground on the line of route. The net profit for the year increased by £495.

The annual meeting was held on Tuesday, at the Electrical Federation offices, Kingsway. Lord Vaux of Harrowden, who presided, said the traffic receipts had been very satisfactory. The net result of the parcels business was slightly better, while the advertising receipts were up £56. The decrease in the sundry receipts of £66 was owing to their having sold less scrap. The expenditure had increased by about £174, which was partly due to the extra car-mileage run during the year under review, and to the general upkeep of the permanent way, cars, &c. They had carried 130,769 more passengers, and the average expenditure per passenger had dropped from ·90d. to ·84d. or ·06d., while the proportion of expenses to receipts had decreased by 5 per cent. The directors recommended that £750 be placed to a provision for renewals account, in order to meet renewals which would have to be faced during 1912. During the present year they had made satisfactory arrangements with the various local authorities for the upkeep of the company's track within and without the borough for the next five years. Their traffic receipts were gradually improving, which tended to show that they had not been, so far, adversely affected by the coal strike.

Mr. E. A. Paris seconded the motion, and the report was adopted.

River Plate Electricity Co., Ltd.—The directors announce that the net revenue for 1911 was £37,200, against £35,026. A dividend on the ordinary stock of 10 per cent. is recommended, and £15,000 is placed to reserve, against £14,000 last year, making that fund £100,000 ; £7,659 is carried forward, against £5,888 last year.

Continental.—Switzerland.—"Motor" Société pour les Applications de l'Electricité, of Baden, is increasing its capital to £1,200,000.

Belgium.—The Bell Telephone Manufacturing Co., of Antwerp, is declaring a dividend of 5 per cent. for the last financial year.

France.—The balance-sheet of La Société Francaise des Cables Electriques, Système Berthoud, Borel & Co., of Lyons, for the last financial year, shows a net profit of £18,470, as compared with only £9,933 in the preceding 12 months.

Rangoon Electric Tramway and Supply Co., Ltd.—The directors' report states (according to the *Financier*) that the permanent way, cars, overhead, and tramway equipment, have during the past year been maintained in an efficient state. During the year to December 31st, the company's cars travelled 1,447,118 miles, a decrease of 25,353 miles, and carried 9,569,922 passengers, an increase of 288,105, the receipts being Rs. 842,033, a falling off of Rs. 37,212. This decrease has been mainly brought about by the financial and economic troubles with which Rangoon has been visited during the past year, severely affecting that portion of the population from whence the tramway traffic is chiefly derived. A considerable improvement is shown in the private lighting and power department, the receipts for current supplied being Rs. 3,89,710, an increase of 33·83 per cent., while the working expenses were 46·13 per cent., a decrease of 5 per cent. The returns from the house-wiring department also again show an improvement. The profits were £2,021, as compared with £769 for the previous year. It is, however, obvious that the work of installing light and power has its limitations. It is satisfactory to note that the falling off in the tramway receipts has been met by the increase in the profits of the departments already referred to, the gross profits from all sources for the past year being £50,733, as compared with £46,177 for the previous year. This result has been obtained without a corresponding increase in the working expenses. The gross profits for the year were £50,733 ; add transfer fees and interests on deposits, £310 ; together, £51,043. Deduct :—Interest on debenture stock, £8,770 ; provision for redemption of debenture stock, £5,619 ; depreciation on live stock, harness, furniture, &c., in Rangoon, £1,225 ; transfer to reserve for renewals account, £10,000 ; and fees of directors and trustees and expenses in London, £2,057 ; leaving £23,371, plus £822 brought forward, making £24,193. Deduct preference dividend to December 31st, £15,000 ; formation expenses, balance written off, £500 ; leaving available for dividend to holders of ordinary shares, £8,693. From the above amount the directors recommend a dividend on the ordinary shares of 4½ per cent. for the year, free of income-tax, which will absorb £7,965, and £728 will be carried forward.

Johnson & Phillips, Ltd.—The directors' report for the year ended December, 1911, states that the profit for the year on trading accounts, &c., after making provision for bad and doubtful debts, and after charging to revenue upwards of £6,000 for maintenance of buildings, plant, &c., amounted to £18,400, plus £2,154 brought forward. From this the following have to be deducted :—Remuneration of directors, auditors' and trustees' fees, £1,370 ; interest on debenture stock, £7,115 ; reserve *re* debenture sinking fund, £5,797 ; interest on second debentures to December 31st, 1911, £1,750 ; depreciation on machinery and plant, &c., £3,139 ; interest on loan, £351 ; carrying forward £1,038. The directors report that the loan of £34,660, appearing in the last balance-sheet, and for which £50,000, short term second debentures were given as security, has been repaid, and that issue of debentures cancelled. A new issue of £50,000 second debentures has been created, and £30,000 of these have been issued. Mr. W. Claude Johnson offers himself for re-election as a director.

STOCKS AND SHARES.

Tuesday Evening.

The fever of the gambling spirit that has been so much in evidence in the Stock Exchange for the past few weeks has spent some of its force, and with severe falls in certain of the leading speculative securities, there has come a pronounced check to business everywhere. Some stress was laid on the foreign complications that might ensue through Italy's action in connection with the Dardanelles, but nobody took this matter very seriously, and what has brought about the decline more than anything else has been profit-taking on the part of those who recently were such avid buyers. Besides the securing of profits, there may have been cutting of losses ; but in any case, it is no bad thing that the speculative movement for the time being should have received a check.

The Home Railway market reflects the general condition of caution in falls that have occurred amongst the Underground issues, of which a 2½ drop in Districts is the most prominent. Underground Electric Income bonds fell 2, but recovered the loss, while the shares eased off to 4½. Metropolitans lost 10s. ; Great Northern and City Preferred have again fallen 5s. Nothing has changed in the intrinsic condition of any of the companies so far as can be ascertained, but people have been buying more than they could carry, and with the advent of the settlement some of the holders elected to part with their stock. It is surprising, in the circumstances, that the reaction should have been so slight, considering the rises which took place previously.

Central London Deferred, with a rise of 5, has proved a brilliant exception to the prevailing dulness, while the Ordinary put on 2. This is due to persistent rumours that two or more of the larger companies are angling for control of the line, the current idea being that whichever company succeeds will pay a guaranted dividend to the Central London, the amount being stated in some quarters as high as 5 per cent., which certainly appears to be an extravagant estimate. City and South London Ordinary, after being up to 43½, reverted to 42½, but there has been further inquiry for the company's 5 per cent. Preference stocks, with the result that the 1901 and the 1903 issues are both a point higher. District 4 per cent. 1st Preference is also better to the same extent.

A smart rise in London United Tramways Preference carried the price up to 4½, at which it shows an advance of 12s. 6d. on the week, while the Debenture stock is 1 higher at 77½. This is the result of the award whereby the London United Tramways Company receives £254,000 in respect of 5 miles of tramway in Hammersmith, and already hopes are being held out that the shares may be within sight of resumption of dividend payments—which, by the way, have been suspended since December, 1908. Other home tramway descriptions are steady, with rises in Bath shares and in British Electric Traction non-cumulative Preference, the declaration of the half-yearly dividend on the 6 per cent. cumulative Preference, having attracted attention to the junior issues.

In the English Electricity division the feature is a drop of 30s. in City of London Ordinary, bringing the price down to 20½; while the Preference at 17 have lost £3 of their 5½ jump of last week. The 5 per cent. Debenture stock, however, is 2 up. The company published last week a contradiction of the statement that the Corporation had entered into negotiations with it for the acquisition of the undertaking, and this brought in sellers with a rush. Nevertheless, there are not wanting some who declare that the deal will go through as they have been predicting all along, but manifestly it is unsafe to deal in the shares at the present time without inside information. In this connection, the cynical epigram may be recalled that more money has been lost over early news and inside information than over any other causes. County of London Ordinary, with a rise of ⅛, justified the hint given here last week that these shares could be accounted cheap at their then price. The Preference shares are higher, and so is the First Debenture stock, while the new Ordinary hardened up to 10s. premium for special settlement. London Electric Ordinary went back ½, but Notting Hill at 10⅞ are ¼ higher, and Westminster Preference improved the turn of the market. A good deal of attention is being paid to the position that is likely to face the lighting undertakings in 1931, but so many cross-currents enter into the question that the man in the street will do well to take with a pinch of salt most of the loose assertions which are being made on the point.

The Telegraph market displays a certain amount of hesitation. West India and Panama have been supported, but the price reacted after an advance, and the First Preference are ½ easier. Western Telegraphs fell ½, and Anglo-American are easier, although Direct United States shares at 8 are ¼ higher. Eastern Preference and Eastern Extension shares have drooped a little, while West Coast of America gained 2s. 6d. The market hardly knows how to take the deplorable loss of the *Titanic* as a market factor. It is argued, on the one hand, that after this all ocean-going ships will have to be fitted with Marconi apparatus. On the other hand, the catastrophe is held to show that the wireless system is still far from perfect. Marconi shares themselves have had a severe fall, the first for many weeks. Last Friday the shares of the American Marconi Company were introduced to the market amidst scenes of wild excitement, and the price touched 4, slumping to 2¼ three days later, from which there was some recovery. Gambling of this sort threw discredit upon the market in the parent shares, and led to a scuttling-out of bulls, who feared that the end of the Marconi boom was at hand. It may be taken for granted, however, that Marconis will be the centre of extensive dealings, both for speculative and investment purposes, for a long time to come; and the prospective purchaser must take his choice between two contentions—one that the shares will go to 10, and the other that they will go to 5. Canadian Marconis dropped to 30s., and recovered to 32s.; Spanish and General, after being 1⅛, picked up to 2 5/16, these movements showing the violence of the fluctuations. There have also been sharp movements in National Telephone Deferred stock, though on balance the net result is small. Attention has been drawn to the Third Preference shares as being under-valued at 6 if the Deferred stock should be worth 150, but here again the change on the week is a mere 1/16 rise.

Foreign Traction and Power shares have been sold pretty freely, possibly to pay differences incurred elsewhere. It is rather surprising to notice how steady the Mexican varieties keep in face of disquieting news from the country. Mexico Trams are down 2, but this followed a rise of nearly twice as much last week. Mexican Light and Power issues have not moved. There was a sharp break in Shawinigan Water in consequence of a fall in Canadian Railway shares, but the company's bonds are ½ up. Kaministiquia Fives are 7 points down, and Montreal Common fell 4. Holders of Rio Trams have been selling pretty extensively, with the result that the price is 1¼ down, but here also the bonds are remarkably firm. Calcutta Trams are better to the extent of 3/16, but Madras Electric Ordinary dropped ¾. Bombay Preference rose ¼, the contradictory movements in these Indian shares arousing interest and not a little perplexity. The Anglo-Argentine group is steady, with the Debenture stocks in demand, and it may be worth pointing out that the second Preference can now be obtained at a trifle over 5, giving a yield of practically 5½ per cent. on the money.

Manufacturing shares are characterised by a drop of 1 in India-rubbers, which has lowered the price to 9, while Edison & Swan 4 per cent. Debenture at 68 shows a loss of 4. Henleys and Callenders are both rather firmer, and Aron Ordinary attracted attention, with the result that the price is better by a few pence. Babcocks eased off a shade, and the rest of the market is steady. The Hydro-Electric Company of Tucuman, has been offering issues of Debentures and shares, and the River Plate Electricity Company, on this, pointed out that the City of Tucuman is already supplied with electric light and power. The River Plate Company is about to offer £30,000 ordinary share capital to proprietors of the existing ordinary stock.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, April 24th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a ,, Nitric .. .. ,,	22/-	..
a ,, Oxalic .. .. .. per lb.	2¾d.	..
a ,, Sulphuric .. .. .. per cwt.	5/6	..
a Ammoniac Sal .. .. .. ,,	42/-	..
a Ammonia, Muriate (large crystal) per ton	£29 10	..
a Bleaching powder .. .. .. ,,	£5 10	..
a Bisulphide of Carbon .. .. ,,	£18	..
a Borax .. .. ,,	£16 10	..
a Copper Sulphate .. .. .. ,,	£24 15	5/- inc.
a Lead, Nitrate .. .. .. ,,	£26 10	..
a ,, White Sugar .. .. .. ,,	£25 10	..
a ,, Peroxide .. .. .. ,,	£33	..
c Methylated Spirit .. .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks per lb.	3½d.	..
a Potash, Caustic (88/90 %) .. per ton	£22 10	..
a ,, Chlorate .. .. .. per lb.	3½d.	..
a ,, Perchlorate .. .. ,,	4½d.	..
a Potassium, Cyanide (98/100 %) .. ,, (for mining purposes only)	7½d.	..
a Shellac .. .. per cwt.	75/-	7/- inc.
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. ,,	£6 10	..
a ,, Recovered .. .. ,,	£5 10	..
a ,, Lump .. .. .. ,,	£5 5	..
a Soda, Caustic (white 70/72 %) .. ,,	£10 5	..
a ,, Chlorate .. .. .. per lb.	3⅝d.	..
a ,, Crystals .. .. .. per ton	£3 5	..
a Sodium Bichromate, casks .. per lb.	3d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£67	..
b ,, Wire, in ton lots .. ,,	£102	..
b ,, Sheet, in ton lots .. ,,	£120	..
p Babbitt's metal ingots .. .. ,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis) per lb.	8¼d.	..
c ,, Tube (brazed) .. .. ,,	10¼d.	..
c ,, ,, (solid drawn) .. ,,	9d.	..
c ,, Wire, basis .. .. .. ,,	8¼d.	½d. inc.
c Copper Tubes (brazed) .. .. ,,	11½d.	½d. dec.
c ,, ,, (solid drawn) .. ,,	10½d.	½d. dec.
g ,, Bars (best selected) .. per ton	£86	..
g ,, Sheet .. .. ,,	£86	..
g ,, Rod .. .. ,,	£86	..
d ,, (Electrolytic) Bars .. .. ,,	£74 10	5/- inc.
d ,, ,, Sheets .. .. ,,	£91 10	5/- inc.
d ,, ,, Rods .. .. ,,	£79 10	5/- inc.
d ,, ,, H.C. Wire per lb.	9½d.	..
f Ebonite Rod .. .. ,,	5/3	..
f ,, Sheet .. .. ,,	4/9	..
n German Silver Wire .. .. .. ,,	1/11	..
h Gutta-percha, fine .. .. .. ,,	..	..
h India-rubber, Para fine .. .. ,,	4/9	½d. dec.
l Iron Pig (Cleveland warrants) .. per ton	53/7	1/6½ inc.
l ,, Wire, galv. No. 8, P.O. qual. ..	£14	..
g Lead, English Pig .. .. .. ,,	£17 to £17 2s. 6d.	10/- inc.
m Manganin Wire No. 28 .. .. per lb.	6/6	..
g Mercury .. .. per bot.	£8 12 6	..
e Mica (in original cases) small .. per lb.	6d. to 2s.	..
e ,, ,, ,, medium ,,	2/6 to 4/-	..
e ,, ,, ,, large .. ,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings ,,	11d.	..
p ,, ,, rolled bars & rods ,,	1/0½	..
p ,, ,, rolled strip & sheet ,,	1/1	..
o Platinum .. .. per oz.	185/-	..
d Silicium Bronze Wire .. .. per lb.	10½d.	½d. inc.
r Steel Magnet, in bars .. .. per ton	£55	..
g Tin, Block (English) .. .. ,,	£207 to £209	£7 inc.
n ,, Wire, Nos. 1 to 16 .. .. per lb.	2/4	..
p White Anti-friction Metals .. per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.) ,,	£29 15	10/- inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

City Electric Light Co., Ltd. (Brisbane).—The directors, in their report for the half-year ended January 31st, 1912, which was adopted at the meeting on March 12th, stated that after making additions to the reserve fund, dividend equalisation fund, franchise and purchase sinking fund, accident insurance fund and renewal replacement and contingencies account, there remained a credit balance of £6,215, which with the balance brought forward from last half-year, made £8,125 to be disposed of. The directors recommended that a dividend be paid of 3 per cent. on the preference shares and of 5 per cent. on the fully-paid ordinary shares, and of 5 per cent. on the contributing shares. The payment of the above-mentioned dividend together with the dividend duty absorbs £5,740, leaving a balance of £2,386 to be carried forward. During the half-year the directors had evidence of the value to the company in most of the employés becoming shareholders thereof.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations April 23rd.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	8¼ — 9¼	..	5 19 0
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10¾ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	100 —102	..	4 8 8
Brompton & Kensington, Ord.	5	10	10†	8¼ — 8⅝	..	5 14 8
Do. 7 % Cum. Pref.	5	7	7	7⅝ — 8⅛	..	4 6 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	4¼ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	+ ¼	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8¼ — 4⅝	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	95 — 98	..	4 1 8
Chelsea, Ord.	5	5	5	4¾ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	7	8	19½ — 21½	—1½	3 14 5
Do. 6 % Cum. Pref.	10	6	6	16 — 18	—3	3 6 8
Do. 5 % Deb.	Stock	5	5	119 —123	+2	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	101 —104	..	4 6 7
County of Durham, 5 % First Mort. Deb.	Stock	5	5	87 — 89	..	5 12 4
County of London, Ord.	10	5	6	10⅜ — 1'½	+ ⅝	5 6 8
Do. 6 % Pref.	10	6	6	11½ — 11⅞	+ ⅛	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	108 —110	+1	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	101 —104	..	4 6 7
Edmundson's, Ord.	5	Nil	Nil	⅛ — ¼	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3 — 5½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	6	6	4⅜ — 4⅝	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4½	..	5 5 3
Do. 4½ % First Deb.	100	4½	4½	93 — 96	..	4 13 9
Hove	5	9	9	6½ — 7	..	6 8 7
Kensington & Knightsbridge, Ord	5	9	9	7¼ — 7⅞	..	5 16 2
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	8	2	2½	1⅝ — 2	— ⅛	3 14 11
Do. 6 % Pref.	5	6	6	4¾ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	92 — 95	+1	4 4 3
Metropolitan	5	5	4†	3⅜ — 4⅛	..	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	101 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	84 — 87	..	4 0 6
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96 — 98	..	4 11 10
Newcastle-on-Tyne	5	4	4†	3⅜ — 3⅞	..	5 3 8
Do. 5 % Pref., Non-Cum.	5	5	5	3⅝ — 4⅜	..	5 14 3
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10½ — 11½	+ ½	5 6 8
Oxford	5	7½	7½	5⅞ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8⅝ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	2	1⅜ — 1⅞	..	..
South London, Ord.	4	5	5	2⅝ — 3⅜	..	6 8 0
Do. 5 % First Mort. Deb.	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1⅜	..	6 1 0
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 11 0
Urban, Ord.	5	5	..	⅜ — ½	..	..
Do. 5 % Cum. Pref.	5	5	..	⅜ — ½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 88	+ ½	5 2 3
Westminster, Ord.	5	10	10	8¾ — 9¼	..	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	5⅛ — 5⅜	+ ⅛	4 4 8

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅜ — 5⅞	..	5 2 2
Calcutta, Ord.	5	8½	7†	6⅞ — 7⅛	..	5 17 3
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	92½ — 94½	..	5 5 3
Canadian Gen. El. Com.	$100	7	7†	116 —120	..	5 16 8
Do. 7 % Pref.	$100	7	7	117 —121	+1	5 15 8
Cordoba Lt., Power and T., Ord.	1	3	3†	⅛ — ⅛	— 1/16	3 4 0
Do. 5 % Deb.	100	5	..	98 — 98	..	5 2 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	93 — 95	..	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	83 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	91½ — 93½	+ ½	5 6 11
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	7/16 — 9/16	..	Nil
Do. 6 % Pref.	1	6	6	⅞ — 1	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103 —105	— 1/16	4 15 3
Madras, Ord.	5	..	..	2⅛ — 2⅝	— 1/16	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102½ —105½	+ 1/16	4 14 9
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	84 — 86	..	5 16 3
Mexican Lt. & Power, Common	$100	4	4	84 — 86 xd	..	4 13 0
Do. 7 % Cum. Pref.	$100	7	7	105 —107	..	6 10 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94½ — 96½	..	5 3 8
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88 — 90	+ ½	5 11 1
Montreal, Lt., H. and Power	$100	7	8	204 —209	—4	3 16 7
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	39 — 41	..	12 3 10
River Plate, Ord.	Stock	10	..	252 —262	..	3 16 4
Do. 6 % Non-Cum. Pref.	Do.	6	6	110 —115	..	5 4 4
Do. 5 % Deb. Stock	Do.	5	5	103 —105	+ ½	4 15 3
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	136 —104 xd	—3	3 11 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	102½ —110½	+ ½	4 10 6
Do. 4½ % Per. Deb.	Stock	4½	4½	103½ —105½	..	4 5 4
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½ —101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92½ — 94½	..	5 5 10
Victoria Falls Power, Pref.	1	Nil	11¾d.	7/16 — 1	+ 1/32	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	104½ —106½	..	5 12 8

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7⅛ — 7⅝	..	..
Do. 5 % Deb. Red.	Stock	5	5	97½ — 99½	..	5 0 6
American Telep. & Teleg., Cap.	$100	8	8†	148½ —150½	— ½	5 6 4
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	8½	8	65 — 67 xd	..	4 9 7
Do. 6 % Pref.	Do.	6	6	107½ —108½ xd	— ½	5 10 4
Do. Def.	Do.	80/-	80/-	25½ — 26	— ½	5 15 5
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	100¾ —102½	..	4 17 7
Chili Telephone	5	7	..	7⅛ — 7⅜	+ 1/16	4 12 7
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	84 — 86	— ⅛	4 13 0
Cuba Telegraph	10	6	6†	9½ — 10½	..	5 11 7
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3⅞	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	7⅞ — 8½	..	6 1 8
Do. 4½ % Debs.	60	4½	4½	99 —101	..	4 9 1
Direct United States Cable	10	4½	..	7⅞ — 8¼	+ ⅛	5 9 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	5†	134 —137	..	5 2 2
Do. 8½ % Pref. Stock	Do.	8½	8½	81½ — 83½	— ½	4 3 10
Do. 4 % Mort. Deb.	Do.	4	4	101½ —103½	..	3 17 4
Eastern Extension	10	7	5†	13½ — 13⅞	— ⅛	5 5 8
Do. 4 % Deb.	Stock	4	4	99½ —101½	..	3 18 10
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust	10	5⅞	6†	10½ — 11	..	5 9 1
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 9 0
Great Northern Telegraph	10	18	18†	33 — 35	..	5 9 1
Indo-European Telegraph	25	13	5†	5⅞ — 6½	+ ⅛	5 9 3
Mackay Companies Common	$100	5	5†	83 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	..	7⅛ — 8⅛	—1/16	..
Do. 7 % Cum. Partic. Pref.	1	16	..	7⅛ — 7⅜	—1/16	..
Monte Video Telephone, Ord.	1	6	6	1 — 1⅛	..	5 6 8
Do. 6 % Pref.	1	5	5	⅞ — ⅞	..	5 10 6
National Telephone, Pref.	Stock	6	6†	99½ —102½	..	5 17 1
Do. Def.	Do.	6	6†	149 —151	+2	3 19 6
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅛ — 6 1/16	+ 1/16	4 2 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½ —103½	— ¼	4 7 2
Oriental Telep. and Elec.	1	8	..	1 1/16 — 1 1/8	+ 1/16	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1 1/16 — 1 3/32	+ 3/32	4 18 8
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½ —101½	..	3 18 10
Reuter's	8	5	5†	12½ — 12¾	+ ½	3 4 0
Submarine Cables Trust	Cert.	6	6	127 —130 xd	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7⅝ — 7⅞	..	5 1 7
Do. 5 % Cum. Pref.	5	5	5	5⅝ — 5⅞	..	4 8 11
West Coast of America	2½	2½	2½	1⅝ — 1⅞	+ ⅛	3 6 8
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	97½ — 99½	..	4 0 5
West India and Panama Teleg.	10	1½	1½†	4⅛ — 4⅜	— 1/16	..
Do. 6 % Cum. 1st Pref.	10	6	6	10¾ — 11	— ⅛	5 9 1
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅞ — 10⅛	..	5 17 1
Do. 5 % Debs.	100	5	5	102½ —104½	..	4 15 8
Western Telegraph, Ltd.	10	7	6†	18 — 18½	— ⅛	5 3 8
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Western Union Tel., 4% Bnds. A	$1000	4	4	106 —109 xd	..	3 13 6
Do. 4½ % Fdg. Bonds	$1000	4½	4½	100 —103 xd	—1	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations April 23rd.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	1/32 — 1/16	+ 1/32	Nil
Do. 5 % Pref.	1	5	5	3/16 — 7/32	+ 1/32	6 8 0
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref.	100	..	..	12 — 14	..	..
Do. Do. Deferred	100	..	..	8 — 10	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	..	91½ — 93½	+ ½	..
Do. 7 % Non-Cum. Pr'f.	100	..	..	38 — 41	+1	..
Do. 5 % Perp. Deb.	100	5	5	93½ — 96½	..	5 3 8
Do. 4½ % 2nd Deb.	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	3	3	86 — 88	+2	3 8 2
Do. Pref.	100	4	4	87 — 89	..	4 10 0
Do. Def.	100	2	2	89 — 91	+5	2 4 5
Do. 4 % Deb.	100	4	4	101 —103	..	3 17 8
City & South London, Ord.	100	1½	1½	42 — 43	..	3 15 9
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	103 —105	..	4 15 3
Do. Do. 1901	100	5	5	104 —106	+2	4 14 4
Do. Do. 1908	100	5	5	103 —105	+1	4 15 3
Do. 4 % Deb.	100	4	4	101 —103	..	3 17 8
Dublin United Trams, 6 % Pref.	10	6	6	10⅞ — 11⅛	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	2⅛ — 2⅜	— ⅛	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	⅛ — ¼	..	..
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅜ — 2⅞	..	4 6 11
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	83 — 85	..	5 17 8
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10
London United Trams, 5 % Pref.	10	Nil	..	4⅛ — 4⅜	+ ⅛	..
Do. 4 % Deb.	100	4	4	76 — 79	+1	5 1 3

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations April 23rd.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Metropolitan Railway Consol.	100	1⅜	1⅞	68 — 68½	— ½	2 14 9
Do. Surplus Lands	100	2⅜	2⅜	68 — 70	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	84 — 91	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	85 — 87	..	4 0 6
Metropolitan District Ord.	100	Nil	..	46¼ — 46⅞	—2¼	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	3½	4½	90 — 92	+1	4 17 10
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5⅞	6	⅛ — 1 xd	..	6 0 0
Do. Def.	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % Pref.	1	5	5	3/32 — 5/32	..	5 10 6
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	97 — 99	..	5 0 0
Potteries, Ord.	1	2	..	2 — ⅛ xd	..	..
Do. 5 % Pref.	1	5	5	1⅛ — 1⅜	..	5 12 8
Do. 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 10
South Metro. Trams, 6 % Pref.	1	6	..	2⅛ — 2⅜	..	5 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 4 0
Underground Elec. Railways	10	..	..	4⅛ — 4⅜	— ⅛	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	91 — 93	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	2 — 3	..	Nil
Do. 6 % Pref.	5	Nil	..	2¼ — 3	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 84	..	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½	5⅛ — 5⅜	..	5 2 4
Do. 2nd Pref.	5	5	5½	4⅞ — 5⅛	..	5 7 4
Do. 4 % Deb.	100	4	4	94 — 95½	+ ½	4 3 9
Do. 4½ % Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Deb.	100	5	5	103 —105	..	4 15 3
Auckland Trams, 5 % Deb.	100	5	5	104 —106	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11¼	+ ¼	5 4 4
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	99 —101	+1	4 19 0
Brisbane Trams Invs., Ord.	5	8	8†	9⅛ — 9⅜	+ ⅛	4 5 4
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8†	141 —144	..	5 11 1
Do. Pref. Ord.	100	6	6	125 —130	..	4 12 4
Do. 5 % Pref.	100	5	5	111½—114½	..	4 7 4
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98½—101½ xd	..	4 8 8
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	103 —105	+ ⅛	4 5 9
Calcutta Trams, Ord.	5	6	..	6⅜ — 6⅞	+ 1/16	4 18 2
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	100 —103	+1	4 7 5
Cape Electric Trams	1	Nil	2½†	⅜ — ½	..	..
City Buenos Aires Trams (1904)	5	5	5	5⅝ — 5⅞	..	4 5 1
Do. 4 % Deb.	100	5	5	101 — 103	..	4 17 3
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	98 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	101 —104	+1	4 16 2
Kalgoorlie Elec. Trams	1	Nil	..	1/16 — 3/16	..	Nil
Do. 5 % A Deb.	100	5	5	91 — 94	..	5 6 5
Do. 6 % B Deb.	100	5	6†	56 — 60	..	10 0 0
La Plata Elec. Trms, Ord.	1	..	..	9/16 — 11/16	..	..
Do. Pref.	1	6	6	1⅛ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Madras Elec. Tr. (1904), Deb.	100	5	5	98 —100	+1½	5 0 0
Manaos Trams & Lt., 1st Deb.	100	5	5	93 — 96	..	5 4 2
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100⅜—102½	..	4 17 7
Mexico Trams Com.	$100	7	7	118 —120 xd	—2	5 16 8
Do. Gen. Con. 5 % Bonds	..	5	5	96 — 98	..	5 2 0
Do. 6 % Bonds	100	6	6	101 —103	..	5 16 6
Para Elec. Rlys. & Lt., Ord.	5	10	10	7 — 7⅛	— ⅛	6 15 7
Do. 6 % Pref.	5	6	6	5 — 5⅛	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	99 —101	+ ½	4 19 0
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1⅞ — 1⅞	..	1 18 1
Do. 5 % 1st. Deb.	100	5	5	101 —104	..	4 16 2
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	99 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	122 —123	—1½	4 1 4
Do. 1st Mort. 5 % Bonds	..	5	5	104½—105½	+ ½	4 15 0
Do. 5 % Mort. Bonds	100	5	5	97⅞ — 98⅜	+ ⅛	5 1 6
Sao Paulo Tram, Lt. and P.	$100	10	10†	207 —210	—1	4 15 3
Do. 5 % 1st Deb.	$500	5	5	104½—106½	+ ½	4 13 11
Singapore Trams, 5 % Deb.	100	5	5	79 — 82	..	5 19 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	98 — 98	..	5 5 8
Un. Elec. Trams Monte Video	5	6	7	5⅞ — 6	..	6 1 11
Do. 6 % Pref.	5	6	6	5⅛ — 5⅛	—⅛	5 12 11
Do. 5 % 1st Deb.	100	5	5	101 —104	..	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	103½—105½	..	4 5 4

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	3/32 — 5/32	+ 1/32	..
Do. 6 % Pref.	1	9	6	3/16 — 5/16	..	7 2 2
Babcock & Wilcox	1	26	28	6⅝ — 6⅞	—1/16	4 2 2
Do. Pref.	1	6	6	1/2 — 19/32	..	3 13 10
B.I. & Helsby Cables	5	10	10	6⅞ — 7⅛	..	6 18 0
Do. Pref.	5	6	6	5⅞ — 6⅛	..	4 16 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	91⅛ — 94½	— ⅛	4 15 3
British Westinghouse, Pref.	3	Nil	..	¾ — 1	..	Nil
Do. Deb.	100	4	4	63 — 66	..	6 1 3
Do. 6 % Prior Lien	100	6	6	99 —102	..	5 17 8
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — ¼	..	Nil
Do. 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 4½ % Deb.	100	4½	4½	54 — 59	..	7 10 6
Do. 4½ % Second Deb.	100	4½	4½	37 — 42	..	10 14 4
Callender's Cable	5	15	10†	10⅝ — 11⅛	..	6 10 5
Do. Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. Deb.	100	4½	4½	98½—100½	..	4 9 7
Castner-Kellner	1	17½	20	3⅝ — 3¾	..	5 6 8
Do. Deb.	100	4½	4½	105 —109	..	4 10 7
Crompton & Co.	8	Nil	Nil	⅛ — ¼	..	Nil
Do. Deb.	100	5	5	58 — 63	..	7 7 1
Dick, Kerr	1	5	..	3⅞ — 3⅞	..	5 8 1
Do. Pref.	1	6	6	1⅛ — 1 1/16	..	5 12 11
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	..	⅛ — ¼	..	Nil
Do. fully paid	5	Nil	..	1⅞ — 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	66 — 70	—4	5 14 4
Do. 5 % Second Deb.	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	Nil	2½†	¾ — 1	..	..
Do. Pref.	2	7	7	1⅝ — 1⅞	..	7 9 4
Greenwood & Batley, Pref.	10	7	7	7½ — 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9½	..	5 5 3
Do. Deb.	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	5	15	10†	11⅜ — 12½	+ ½	6 0 0
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 6 9
Do. Deb.	100	4½	4½	104 —106	..	4 4 11
India-Rubber, G. & T.	10	10	..	8½ — 9½	—1	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	20	10†	33 — 35	..	6 15 2
Do. Deb.	100	4	4	99½—101½	..	4 9 0
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	5	Nil	..	¾ — 1½	..	Nil
Do. Deb.	100	4	4	59 — 61	..	6 11 2

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3½ per cent., February 8th, 1912.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MARCH, 1912.

Contrary to what one might have expected, the returns of electrical business for March reached a very satisfactory total.

A huge telegraphic export, such as occurs periodically, resulted in the exports reaching the large amount of £821,976, a figure which has only once been exceeded in our returns. Although this total includes nearly £450,000 worth of telegraphic material, the other exports amounting to £372,000 were still some £22,000 better than the comparable figures of the previous month.

The month was a good one for the machinery exporters, whose share of the business reached £160,000 in value, while the cable exports were very little less than in February.

The imports amounted in value to £248,651, as compared with £222,714 in February, showing a general improvement, but particularly in the machinery lines which reached over £100,000 in value. The re-exports reached £23,374 in value, or somewhat more than usual, the previous month's total being £18,129.

Of our customers, Egypt for once takes the first place, its total including £380,000 of telegraphic material (submarine cable), although activity in telegraphic matters is shown in several other directions. India, Japan, Australia, &c., were also prominent buyers.

Amongst the importers into this country, Germany, as usual, was most prominent, and it may be worth noting that glow lamp imports principally from that country, reached a total of over £35,000.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	972	1,471	266	31	...	440	5,209	2,473	43	...	226	646	11,777
Germany	1,628	491	...	32	603	25	391	280	25	...	25	198	3,698
Netherlands, Java and Dutch Indies ...	1,568	866	130	...	...	153	1,123	664	...	...	16	32	4,552
Belgium	297	210	72	16	578	32	4,438	1,679	...	...	1,334	171	8,827
France	1,655	...	1,486	...	28	...	12,479	676	...	...	174	135	16,633
Portugal	73	176	18	35	...	...	632	...	4	...	228	...	1,166
Spain, Canary Isles and Spanish N. Africa...	661	25	91	11	20	630	1,203	111	4	...	...	213	2,969
Switzerland, Italy and Austria-Hungary ...	1,233	14	118	39	95	...	3,234	681	...	...	117	602	6,133
Greece, Roumania and Turkey	149	153	1	50	...	...	24	...	281	...	113	1,679	2,450
Channel Isles, Gibraltar, Malta and Cyprus...	78	23	29	75	...	172	203	...	45	...	19	23,080	23,724
U.S.A. and Cuba	152	...	16	1,210	22	17	2,259	...	3	49	...	706	4,434
Canada and Newfoundland	1,072	4,009	403	2,078	135	2,465	6,366	86	1,382	...	466	1,229	19,691
British West Indies and British Guiana ...	106	...	7	334	...	...	140	...	42	14	120	297	1,060
Mexico and Central America	5	...	...	15	...	20	276	...	...	...	14	44	374
Peru, Uruguay and Paraguay	412	...	21	66	...	306	417	...	7	...	907	125	2,261
Chile	339	250	513	217	64	738	1,332	719	4,436	113	74	505	9,300
Brazil	234	1,782	187	102	...	135	2,970	1,377	59	13	169	2,054	9,082
Argentina	2,891	8,064	405	1,266	180	1,231	7,946	1,064	1,362	15	7,500	72	31,996
Colombia, Venezuela and Bolivia	24	...	...	17	...	43	444	...	...	...	10	...	538
Egypt and Persia	319	558	169	94	101	3	2,072	255	505	...	50	380,364	384,490
British West Africa and St. Helena ...	409	337	135	145	...	29	1,026	5	14	...	59	210	2,369
Rhodesia, O.R.C. and Transvaal	2,264	242	584	1,530	24	377	5,663	55	525	...	181	1,496	12,941
Cape of Good Hope	1,599	2,410	290	922	...	339	2,729	487	1,283	...	150	317	10,526
Natal	705	6,098	493	1,201	47	11	2,199	1,456	8	162	175	726	13,281
Zanzibar, Brit. E. Africa, Mauritius & Aden	39	65	79	166	...	71	502	10	4	...	702	18,682	20,320
Azores, Madeira, Portuguese Africa, &c. ...	504	892	223	95	43	116	1,584	2	155	...	...	10,025	13,639
French African Colonies and Madagascar ...	...	...	...	...	...	...	106	587	...	...	...	38	731
China and Siam	644	313	180	333	...	...	5,540	525	655	...	222	168	8,580
Japan and Korea	711	...	492	...	...	5,953	19,101	8,153	2,138	284	5,669	...	42,501
India	2,832	12,441	3,336	4,479	485	581	11,204	1,549	2,649	118	3,479	745	43,898
Ceylon	272	317	105	156	...	10	270	203	120	...	245	183	1,881
Straits Settlements, Fed. Malay States and Sarawak	688	821	290	33	...	257	344	289	56	213	307	386	3,684
Hong Kong	607	820	459	341	1,246	159	906	...	62	255	721	...	5,576
West Australia	221	...	420	509	...	337	2,556	...	1,767	...	336	589	6,735
South Australia	378	2,664	181	192	...	324	1,141	...	124	...	1,806	12	6,822
Victoria	2,646	6,285	662	1,813	...	822	6,517	3	2,012	...	5,469	2,274	28,503
New South Wales	3,503	9,547	264	928	271	195	12,268	1,515	782	...	5,529	18	34,820
Queensland	793	60	53	223	...	300	811	100	79	...	171	1,781	4,371
Tasmania	20	502	...	...	...	...	...	...	...	...	783	...	1,305
New Zealand and Fiji Islands	1,340	3,504	802	717	...	317	3,625	3,627	136	...	161	109	14,338
Total, £	34,043	65,410	12,980	19,471	3,942	16,608	131,250	28,631	20,767	1,236	37,727	449,911	821,976

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Norway, Sweden and Denmark	42	...	...	105	...	20	9,573	...	434	...	7,045	17,219
Germany	2,340	7,815	1,783	30,896	7,442	2,506	72,907	5	937	7,495	30,607	164,733
Holland	...	...	...	1,427	334	...	12	...	...	16	12	1,801
Belgium	568	945	22	6	12	...	2,244	1,474	79	963	8,407	14,720
France	248	35	1,309	2,151	1,119	472	801	406	1,684	3,291	501	12,017
Switzerland	193	830	14	...	...	...	852	...	...	...	...	1,889
Italy	16	104	...	...	...	...	...	31	...	...	4,949	5,100
Austria-Hungary	30	484	...	446	120	...	48	...	...	860	616	2,604
United States	2,603	383	299	581	2,598	14	9,690	10,996	659	145	200	28,168
Total, £	6,040	10,596	3,427	35,612	11,625	3,012	96,127	12,912	3,793	12,770	52,337	248,251

Additional imports: New South Wales, machinery, £49; Canada, machinery, £136; Spain, carbons, £215.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	11,247	828	...	2,093	408	...	7,345	...	430	650	373

Total Exports: £821,976. Total Re-Exports: £23,374. Total Imports: £248,651.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

AN ELECTROLYTIC STERILISING PLANT.

A novel and interesting application of electrolysis to the industrial sterilisation of water has been carried out at a textile mill in the north country. At this mill, which is devoted to the woollen dyeing and finishing processes, a supply of water is obtained from moorlands on which cattle are grazed, so that there is some slight contamination from this source; the result was formerly the rapid growth of algae in the storage reservoirs, which filled up the supply pipes. Grids were useless, as the fine silky threads lay across the grids in a felted mass which had to be removed with rakes every half-hour, and the threads thus broken and released got into the mill and on the goods, whence they were irremovable.

Chloride of lime solution destroyed the weed, but hardened the water; the result was that scale formed in the boilers and curdled the soap used in the fulling and finishing of the woollens, so the use of this chemical had to be abandoned, and the weed soon reappeared. Copper sulphate was tried, but this at once affected the dyes.

Mr. Toyne, the consulting chemist, was acquainted with Dr. Samuel Rideal's investigations into the subject of water purification, wherein the use of electrolytic sodium hypochlorite was advocated, and as a last resource he tried the electrolyser made by Messrs. Ernest Grether & Co., of Manchester. After three days' trial this proved entirely successful; the weed was killed, and the water—which had previously been tinged slightly yellow, owing to the infiltration of peaty matter—was changed to the ordinary blue-green of pure river-water. The proper strength of chlorine to effect the purpose was ascertained by experiment, and amounted to about two parts chlorine to 1,000,000 parts water. The little "Manchester" electrolyser which was used is illustrated in diagram herewith. A couple of planks were thrown across the little stream which fed the reservoir, and the apparatus was mounted on these, so that the electrolytic sodium hypochlorite, as made, trickled into the brook, and was thus intimately mixed with all the water that entered the reservoir. An automatic feed tank was provided at a higher elevation, and a hogshead of brine higher still, as shown, so that, after filling the hogshead once a day, the operation of the plant was entirely automatic. A little roof, not shown in the diagram, protected the apparatus from the weather. Current was provided from the mill-lighting circuit at 110 volts by means of an overhead line; the current amounted to about 8 amperes, and the outflow from the electrolyser was at the rate of 1 litre per minute, with a strength of 3 grammes active chlorine per litre. The brine had a strength of 4 per cent.

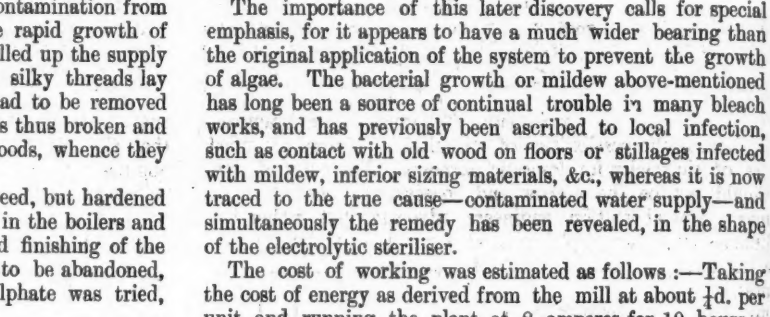


Diagram of Electrolytic Sodium Hypochlorite Sterilising Apparatus.

When the amount of chlorine required had once been determined, it did its work in the reservoir, and spent itself on the organic matter therein; there was no chlorine present at the outflow. Daily chemical tests failed to show either chlorine or nitrogenous matter, and the dyes were not affected. If any free salt was present, the quantity was too small to be detected, and in any case it was harmless. The water was excellent for drinking purposes, and, in fine, the experiment was a great success from every point of view.

The subsequent development of this experiment is even more interesting: as winter set in, it was decided to stop the electrolyser, as no growth of algae takes place in cold weather; at the end of a fortnight complaints were made of the reappearance of peculiar markings, or stains, on the material in course of treatment, which excited comment, seeing that this old trouble had been absent during an exceptionally hot summer. The bacterial action of the water was at once suspected, and the electrolyser was restarted, when the fungoid growths at once disappeared. Needless to say, instructions were issued to run the electrolyser henceforth summer and winter.

Further experiment has shown that in winter, when the growth of vegetation is suspended, the amount of electrolytic sodium hypochlorite may be reduced to 1 part per million, the contaminated water thus treated refusing to show any action on gelatine plates.

The importance of this later discovery calls for special emphasis, for it appears to have a much wider bearing than the original application of the system to prevent the growth of algae. The bacterial growth or mildew above-mentioned has long been a source of continual trouble in many bleach works, and has previously been ascribed to local infection, such as contact with old wood on floors or stillages infected with mildew, inferior sizing materials, &c., whereas it is now traced to the true cause—contaminated water supply—and simultaneously the remedy has been revealed, in the shape of the electrolytic steriliser.

The cost of working was estimated as follows:—Taking the cost of energy as derived from the mill at about ¼d. per unit, and running the plant at 8 amperes for 10 hours a day, the consumption of energy was $110 \times 8 \times 10 = 8{\cdot}8$ units, costing, say, 2d. a day. The brine used amounted to 132 gallons of 4 per cent. density per day, requiring 52 lb. of salt, which, at the price paid by the dye-house, cost 5d. The labour and attendance required was negligible, and the total cost thus came to about 7d. a day.

The installation was at work all last summer during the exceptionally hot season, and has been in operation for nine months, to the entire satisfaction of the owners of the mill. The system is, of course, applicable to a great variety of cases in which water is contaminated with organic impurities—for example, it can be used to purify the water of swimming baths, as is already done at Poplar by Dr. Alexander, with excellent results.

An Improved Accumulator.—It is reported that Prof. Hannover, of Copenhagen University, has invented a method by which it is possible to charge an accumulator with five times as much electrical energy as any other existing accumulator of the same size.

Electric Clock Installations.—Installations are to be carried out by the Magneta Time Co., Ltd., at the Imperial Hotel, London (380 dials), and the Marconi Co.'s new premises, Strand. The apparatus will be identical with the equipments installed throughout the Chief Postal Buildings, London.

SOME SECOND THOUGHTS ON PUBLICITY.

By R. BORLASE MATTHEWS, M.I.E.E.

It has often been stated that second thoughts are best, possibly because there is generally more time for consideration, or perhaps more likely they are looked upon from a different and broader view point. In the issue of the Electrical Review, dated April 12th last, an article, by Mr. C. H. Wordingham, entitled "Some Thoughts on Publicity" was published. The present article is written with the view of getting the readers of the aforementioned "Thoughts" to entertain some second thoughts, which, it is hoped, will be less pessimistic and much more practical, concerning the possibilities of stimulating a more extended use of electricity for domestic purposes. The point of view should not be the narrow and conservative one which so many central station engineers advocate, but rather the broader one of successful general commercial enterprise. If a leaf be taken from the book of a successful man of business, the theme of "Publicity" will be found writ large upon it. But, as may be inferred from Mr. Wordingham's article, there must be a proper interpretation of what is covered by the term "Publicity." It can be, perhaps, best expressed as "Good salesmanship," in the best sense of the term, where it is a case of once a customer always a customer, and not an instance of "sold again" and a dissatisfied buyer.

The principal reason preventing the general use of electricity for domestic purposes can be summed up as due to lack of publicity organisation, to the non-existence of salesmanship of any kind, and to unbusinesslike methods in retailing apparatus of all descriptions. The present somewhat high cost of certain apparatus, which is undoubtedly a drawback to its sale, could be greatly reduced if the retailing were carried out on sounder lines—lines which would, of course, include an educational campaign for the instruction of the general public. Given good salesmanship, the price of current within reason is not really a serious item, as the average householder has no idea as to the comparative costs of gas, coal, or electricity for lighting, heating and cooking. We require the good results obtained from good service, and if an electricity supply undertaking is properly managed, that good service can be given without cutting the price per unit. It is but a poor salesman who secures orders on price alone. The present medium for retailing is either through the central station or the contractor. Unfortunately for the electrical industry as a whole, neither of these sources is anywhere like as efficient as it might be. There are, of course, a few brilliant exceptions, but their very existence emphasises the lack of businesslike aptitude on the part of the majority.

If electricity is going to be more largely used for domestic purposes, each central station should have one man at least who would devote his entire time to the commercial side of the business, a man who is capable of organising a sales department that compares with those of first-class business houses.

The operation of a central station does not present a tithe of the difficulty which is encountered by the ordinary business house, for it is monopolistic in character and is confined within a limited territory that is extremely easy of access. An objection may be raised to the effect that this employment of a special business manager is a costly method. He is, however, an employé that an ordinary business house would not do without, and he will be of vital importance to the central station, for he will ensure its prosperity. An energetic man in such a position is an invaluable asset, and the day is rapidly approaching when such men will occupy premier positions in central station management, because the engineering problems have now been practically solved, and it is of far more importance to increase the sales, and thereby the output of the station, than to effect some fractional saving in the coal consumption.

An insignificant amount of advertising and educational work has been done by central stations, as they do not seem to be far-sighted enough to realise to the full advantages that would accrue to them if this matter were properly followed up. The Publicity Committee of the London Electrical Supply Undertakings are certainly to be commended for their attempts to secure co-operation in this direction, and it is pleasing to note that some 250 undertakings now use the literature they supply. It is, however, but a mild expression to say that the Committee is merely playing at the business. Considering the difficulties under which they are working—the Committee is a body of gentlemen who have to snatch a brief interval from an already overcrowded business day, to advise and consider matters upon which they are not experts—they must be warmly congratulated upon their success. Surely, however, it would be to the best ultimate advantage of supply undertakings to employ a permanent staff who were specialists in publicity.

Pending the adoption of the principle by central stations that they must have a commercial manager, it is essential that the gap be partially covered by those central station engineers who have not already done so, following the so-called publicity "fashion," and acquiring more definite and practical information about the various applications of electricity, and then seeing that this information is disseminated in the best possible manner among their present and prospective consumers. A difficulty, of course, is the compilation of the required information. There is a lot of most useful information available, but it is not in a collected form, with the exception of the handbook entitled "Electricity for Everybody," which has been specially prepared for the assistance of central station engineers, their assistants and canvassers. Such a compilation should be edited jointly by the Committee of the London Electricity Supply Undertakings, the Municipal Electrical Association, and backed up by the co-operation of the British Electrical Manufacturers' Association, and, if feasible, fathered by the Institution of Electrical Engineers. An idea of this kind has already been carried into effect in the United States with very beneficial results.

As a typical instance of the lack of knowledge on the part of central station engineers as to the practical details of domestic applications, the electric oven may be cited. Very few central station engineers have any idea as to the style, capacity and size of oven required. As another example, the possibility of the use of small motors, or preferably the universal motor, for alleviating the household work is practically an unknown factor.

Reference was made during the early portion of these remarks to the matter of good salesmanship being of more importance than the actual price for current. In this connection an excellent illustration is the advantage to be gained by cooking meat by electricity over any other method. To put the matter concisely, the statement may be made, and honestly made, that if coal or gas cost nothing, and the price of electricity were twice as much as is actually the case, it would still be cheaper to cook a joint of meat by electricity.

Take for example:—To obtain 12 lb. weight of meat ready cooked and available for serving, it is necessary to put 13 lb. 10 oz. into an electric oven, but if the cooking is to be done in any other way, at least 17 lb. 2 oz. will have to be put into the oven, showing an economy in weight of 3 lb. 8 oz., or in hard cash, 2s. 11d., whereas the actual cost of cooking the joint either by electricity or gas would only be in the neighbourhood of 3d. This, then, is an illustration of the sort of way in which a consumer's attention should be drawn to the advantages of electricity. In themselves the facts are convincing, and they are emphasised by their direct appeal to the householder's pocket.

Very few central station engineers or contractors fully realise the enormous possibilities of electric cooking as a means of greatly increasing the sales of electrical energy. Hence, it behoves those who are interested, to get their information and data in such shape that they will be able to cope with the big demand for electric cooking apparatus that has now undoubtedly well started. There are many fears expressed to the effect that distributors will be overloaded. However, before there is a likelihood of this occurring, undoubtedly other changes will have taken place. When speaking at the last meeting of the Institution of Electrical Engineers, Mr. A. H. Seabrook made the statement, that, notwithstanding the enormous increase in demand for current for cooking and heating in their district, they had not yet had to increase their distributors.

Reverting more definitely to the article referred to at the commencement of this one, it is evidently assumed that there is very little discrimination on the part of central station engineers as to what apparatus should be recommended. In dealing with the possible applications of electrical energy in the ordinary English household, the comments made are very antiquated, and do not indicate an intimate acquaintance with practical domestic applications or requirements. The vacuum cleaner does not merely replace the dust-pan and broom, for it does work that these time-honoured domestic tools cannot do. Where a good vacuum cleaner is regularly employed, only a negligible quantity of dirt will be found under the carpets at spring-cleaning time. One maker alone sells about 50 vacuum cleaners per week; obviously he could not sell this number unless they accomplished something that could not be done more effectively and cheaply in another way.

Capital cost does not necessarily prohibit the purchase of things for the furnishing of a home, or else the makers of piano-players, would never sell an instrument. Servant troubles are getting more and more serious in this country, hence housework must be facilitated by mechanical aids, so that the work may be done without too much labour during a temporary interregnum. The time is not far off when good servants will only take a situation where they can get mechanical assistance in their work.

To sum up: Education is still lacking in the application of electrical energy to domestic purposes and publicity is the means whereby that education is to be provided; it is not a fad or a fashion, but a necessity.

AUSTRALIAN TRAMWAY COMPANIES AND THEIR EMPLOYÉS.—I.

The relations between the Australian tramway companies and their employés have, during the past six months, formed a principal rallying point in the industrial struggle now proceeding in that Continent between capital and labour. In Brisbane that struggle has caused a general stoppage of work extending over a considerable period, and in Adelaide it threatens a similar condition of affairs. These general stoppages are, of course, caused by the Federated Trade Unions of the various States making the tramway-men's case their own, and in no sense do they mean that the industrial life of a city is dependent upon the maintenance of an uninterrupted tramway service.

The Commonwealth of Australia have established an Arbitration Court specially to hear and adjudicate upon labour disputes, and this Court deals with and recognises employers and associations of employers, and workers and associations of workers or Trade Unions. Legal representation is not allowed the parties in this Court, the production of evidence and examination of witnesses having to be carried out by the employers or their representative officials and by the officials of the Trade Unions. The Court is empowered to intervene and act in the case of trade disputes in which the President has held a Conference and no agreement has been reached, and which have then been referred by him to the Court. Such disputes must extend beyond the limits of any one State. Further, in the case of such a dispute, if work has ceased as a result of either "strike" or "lock-out," such case has precedence over all other cases, and is heard and decided on at once.

For some years there has been a tendency on the part of the tramway employés in the various States to form Trade Unions, and in November, 1910, the Australian Tramway Employés, embracing the various State Unions, was formed. It is stated that the membership of this Association is about 3,600, excluding New South Wales, distributed as follows:—Victoria, 1,750; South Australia, 500-600; Queensland, 480; West Australia, 180; Tasmania, 68. The formation of these Unions was discouraged by the tramway companies, who in some cases, notably at Brisbane, favoured the formation of workers' Unions confined to their own employés. These Unions, called by the workers Companies' Unions, have small memberships, and are bitterly resented by the members of the larger Unions. Feeling runs high between the majority and minority of the employés, and this feeling is to a large extent shared by the Trade Unionist section of the general public.

In February, 1911, three months after its formation, the Australian Tramway Employés Association decided that a distinctive badge should be worn by its members, and in August these were ready. In May, Mr. Badger, the manager of the Brisbane Electric Tramways Co., had issued a regulation forbidding the wearing of any badges other than those provided by the company, when the men were on duty or in uniform.

Meantime, the new Association had prepared a long claim covering rates of pay and general conditions of service, which they lodged with the Arbitration Court in October, citing eleven of the principal tramway companies in Australia as respondents, amongst them being the Brisbane Tramways Co. One of the claims made in this suit was the right to wear the Union badge when on duty. It will be necessary to refer to this claim later; it came up for hearing in the Federal Arbitration Court on March 4th last.

The tramway employés in Brisbane commenced on January 18th last to attach their Union badges to their watch-chains, and wear them while on duty. This act was considered by the manager of the tramway company a breach of his regulation, and some of the men were suspended. No notice was given the men, and as they refused to give up the badge, they were stopped from duty, and the tramways for a time practically ceased working.

This, on February 1st, was the signal for a general strike in the city, which has greatly disturbed the trade of the city. The men's Union then brought an action in the Federal Arbitration Court impugning the legality of Mr. Badger's prohibition of the wearing of the badge, on the ground that it was contrary to the Commonwealth law under which the Association was registered.

A strike being in progress, this case had precedence over others, and the hearing was commenced before Mr. Justice Higgins, in Melbourne, on March 16th last. The case occupied six days, and judgment was given on the 27th of the same month. Great public interest was aroused, the leading newspapers giving full reports of the evidence.

At the commencement exception was taken by Mr. Badger to the jurisdiction of the Court on the ground that the disturbance was confined to one State. This was overruled by the Judge, who pointed out that it formed a part of the general case affecting all tramways awaiting trial.

Many witnesses were examined on both sides, and the ill-feeling existing between the members of the opposing Unions was clearly proved. The attitude of the tramway company towards the men's Union was explained by Mr. Badger. A recreation room had for a long time been maintained by the Tramway Co. for all its employés. After the formation of the men's Union, the smaller Union composed of the company's employés only was brought into existence, and the company restricted the privilege of using this recreation room to the members of the smaller Union. This seems to have caused considerable resentment, and explained a good deal of the strained feelings between the parties.

It was argued that the wearing of the badge was intended to intimidate wearers into joining the Union, and to make the position of those who refused intolerable. On the men's side this was denied, and it was stated that its object was to enable members to recognise one another and to converse together on Union matters. It was pointed out that well-known societies were in the habit of distributing badges to be worn by their members.

Three weeks after the dispute commenced it was stated that out of 482 men locked out by Mr. Badger, only one had returned, while their places were being filled up by the company, who were gradually restoring the normal service.

The Judge gave a decision in favour of the men, holding that the regulations forbidding the wearing of the badge were illegal. This judgment affected not merely the Brisbane company, but also the Melbourne and Adelaide companies, who had issued similar prohibitions. In using the powers conferred upon him by the company's articles of association, Mr. Badger had not obtained either the approval of the Governor or published it in the *Gazette*. The judge also decided that an employé has a right to wear what he likes so long as it does not offend against decency, and that a tramway company has at law no more right to decree what his employé may not wear than he has to demand he shall attend a particular church or wear any particular make of clothes.

So far as the wearing of the badge was concerned the gain lay with the men, but the Court pointed out that they had no power to force the Brisbane Co. to reinstate the men out of work. It would seem, therefore, that the men have won a rather Pyrhhic victory, as the right to wear a badge at work when they have no work to do is rather a barren possession.

The question, however, is to be further contested by the companies, but in the meantime an injunction has been granted enforcing the judgment.

Football.—On the well-appointed ground of the "Hartonians" F.C. at Lea Bridge on the 13th inst., the Staff and works employés of the Hart Accumulator Co., Ltd., met in friendly rivalry, and after a hard-fought encounter the "Clerics" were successful by the odd goal in 7. Play during the opening moiety was very even, and it was half an hour before the score was opened, Kempen and Elliott then notching points for the Staff in quick succession. The works men responded gamely, and a misunderstanding between the backs enabled Gullen to reduce the lead, whilst following a run by the same player, a Staff half-back kindly obliged by putting through his own goal, thus equalising matters. In the homeward journey the Staff early took the lead with a long shot by Bourke from half-back, and Elliott then placed a corner so well that the Works goalie fisted through in a vain endeavour to clear his lines. In the closing minutes the Works rallied, Ingram netting with the best shot of the match, but despite strenuous endeavours they were unable to further improve their position. A draw would have better reflected the play, as although the Works were more together than their opponents they were not so dangerous in front of goal The game was very fast and cleanly contested, and was fought out with the best of feeling. Mr. Benham enhanced his reputation by the manner in which he ndertook the duties of referee.

PROCEEDINGS OF INSTITUTIONS.

Notes on Power Station Working.

By J. W. Jackson.

(*Abstract of paper read before the* Institution of Electrical Engineers, *at Newcastle-on-Tyne, March 25th*, 1912.)

To-day we find that the mechanical side of a station requires exactly the same close attention that it always did, and that the electrical side of a station very nearly takes care of itself. The immediate future should intensify this difference still further when it is remembered that switchboards are being built of the ironclad type, with which it is almost impossible for accidents to the roof or failings of the guarding against vermin, &c., to affect the switchboard. The present-day design of high-class oil switch appears to be not very far from perfection from a general commercial point of view. The protection gear for the cables is also working out in very much the same way. A few years ago a breakdown on a big system would seriously affect a good deal of that system, and very often the whole of it. To-day we find balanced protective relay gear of a very high discriminating value, so much so that when cables break down it is seldom that any other portion of the system is affected than that fed by the particular cable. Even this difficulty is reduced where anything approaching a ring main is in service. Further, because the relay gear has become so discriminating, the present-day oil switches are made to operate at such a high rate of speed that the shock to the generating station becomes comparatively small. This point is borne out by the evidence of the breakdown of the cable. Faults on cables are often difficult to locate because the rupture on the broken-down portion is such a small one that it often seals itself up again, whereas in the past there was very little chance of a cable again becoming insulated.

A very real and solid advance has been made in steam turbo-alternator design and operation. Short turbines have many advantages over long ones; they are cheaper to build, safer at fine clearances, no less efficient if run at suitable speed, and they can deal with highly superheated steam.

The difficulties of the pure reaction type are due to increased length with size, coupled with fine clearances, both of which are necessary to give the maximum possible efficiency. This makes unwieldy machines above a certain capacity. Above a certain size the speed must be reduced, thus calling for a turbine still bigger and longer. The impulse-compounded and the impulse-reaction types shorten the machine to a reasonable length and allow of its being built inside one casing.

Turbines are now built that can be put to work for a whole year at a time dealing with ordinary service conditions without requiring to be opened out, and at the end of that period this is done for inspection purposes only.

It would appear from present practice that the turbines to meet general commercial purposes most successfully must be of the mixed type—that is, of the reaction and impulse types combined, the favourite design at present being known as the disk and drum. Nearly all turbine builders are building it, with very encouraging results.

Several different types of condensers have been put on the market in recent years, owing to the demand of the turbine for superior vacuum. It has now been found possible to design a condenser so that the section of its effective body is of the shape of an isosceles triangle (fig. 1). One very successful condenser of this type is of the triangular principle, but arranged in the usual circular body (fig. 2), so that the triangle is cut up into three portions. With a first cost very little higher than a simple condenser, this allows of the condensed water being withdrawn at a temperature within a very few degrees of the exhaust steam entering, while producing the vacuum of about 1·25 in. to 1 in. mercury of absolute pressure. With the simple type of condenser the same vacuum can be obtained, but the condensed water is of a temperature from 20° to 30° lower than that of the exhaust steam entering.

It now seems certain that for nearly all purposes the centrifugal pump will displace the ram pump. The efficiency is very high, the maintenance charges are very low, and the reliability is considerable. The main reason for this is that the centrifugal pump takes its water in a manner that is almost entirely free from shock. This action reflects itself throughout the system, as where a centrifugal pump is used, little danger is experienced with non-return valves, check valves, starting of pipe joints, cracking of cast-iron pipes, &c., and in the event of a stop valve being shut down by mistake against a centrifugal pump, there is very little danger of the pipes or pump being wrecked, as is the case with a ram pump.

Centrifugal pumps are now being used for extracting the condensed water from condensers operating under high vacuum. Provided they are of proper design in the first instance, if the suction side of the pumps is kept clear of air, very little difficulty will be experienced. Many pumps in this country have been running for a year and upwards under such conditions.

A still later development of the centrifugal pump is the rotary air pump. Owing to its special design of impeller and casing, it is able to build up a vacuum and give better all-round results, from maintenance and efficiency points of view, than the old-fashioned plunger pump. This rotary pump can be made of generous capacity for its work and yet occupy a very small space. One make of this pump is assisted by a steam jet, operating in series with the pump. The steam jet deals very effectively with an "air" overload in the shape of the leaks which occasionally occur. Combination sets of this type have a most promising future before them.

Centrifugal pumps have also for some years been used for pumping the feed water into boilers, and for this work it is very difficult to imagine a better type of pump.

Almost all big power stations now employ water-tube boilers only. A boiler with straight tubes that are nearly vertical must surely be the best boiler for all-round purposes. With the best of boiler arrangements and feed-water filters, a considerable amount of mud is found in the boiler water as a result of the completion of the water softening taking place in the boiler. With straight vertical tubes this mud has a chance of slipping into the bottom drum, which should be of fairly large capacity, and so settling to a place where it can be dealt with. Wherever tubes approach anything like the horizontal line, there is always a danger of their being choked with mud at that point where the water is first subjected to the heat treatment which completes the final softening. It is very seldom indeed that trouble from this direction is found on a horizontal tube where that tube is in the front line of steam generation. The circulation set up in this case by ebullition

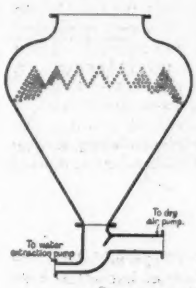


Fig. 1.

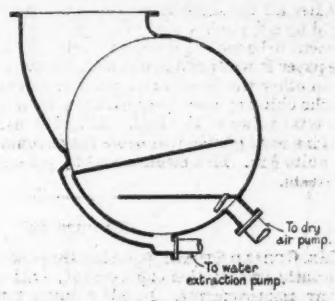


Fig. 2.

is sufficient to remove all solid matter in the ordinary way, except where the water has been insufficiently softened, in which case a hard scale forms on the tubes. A vertical tube does not offer a surface that soot can readily cling to, and this is a very important consideration.

This type of boiler calls for a number of drums into which the tubes are expanded directly, and this arrangement has much fewer joints to make and keep tight than most of the various horizontal tube boilers. This makes inspection a comparatively simple job.

A straight-tube boiler has a considerable advantage over a bent-tube boiler of almost any make. For replacement a comparatively small stock of tubes is needed, and all straight-tube boilers have tubes usually of the same diameter and length, whereas with bent-tube boilers an almost equal number of each type of tube needs to be kept in stock, some boilers having as many as 20 different types of tubes.

Close attention to economisers is well repaid in prolonging the life of the metal as well as keeping the economiser casing airtight. By looking after air-leaks on a boiler and economiser combined in regular commercial service, it is possible to reduce heat losses going up the chimney to about 10 per cent., whereas a neglect of precautions will allow these losses to rise to as much as 30 per cent., and still afford little evidence of what is going on by observation of the colour, which, of course, means the temperature of the flame in the furnace.

The economiser of the future undoubtedly is one built on the Contraflo principle. The water will enter at the gas outlet end, passing in series through groups of sections until it reaches the gas inlet end. Experiments have already been carried out on these lines, showing a higher efficiency than with the economiser arranged as a simple economiser. The cost need not be higher than that of the simple economiser.

The frequent blowing down of boilers is a very important matter, and the only safe course to adopt where steam turbines are used is to have the boiler water analysed quite frequently, and the density of solids kept down so low that there is no danger of priming. Almost any boiler on the market will prime badly if the solids are allowed to reach a sufficiently high figure. Dangers from priming with a reciprocating engine are well known, but with a turbine other kinds of trouble follow. One trouble which is well worth mentioning here is that the blades may become choked with mud, usually at a point where the pressure of the steam in the turbine is about atmospheric. When turbines are run with the boilers in a dirty condition for long periods, this matter gradually fills up all available spaces, and its presence cannot but affect the efficiency of the turbine.

A great number of the mechanical stokers which are regularly advertised to-day are really first-class in their particular line of work. Each coal requires a set of conditions which will be settled by its particular requirements.

Where it is possible to run with a high CO_2 in the furnace, which means a high temperature in the furnace, the outlet gases will be reduced to an appreciably lower temperature than would be the case if exactly the same amount of load was being dealt with, with a lower CO_2 in the furnace. Also a smaller amount of power, owing to a reduced water gauge, is absorbed by the induced-draught fan when a high CO_2 is being maintained.

By keeping the casing tight, a comparatively low CO_2 can be run in the furnace and still give a fairly high efficiency. If, however, it is possible to run the temperature up, which corresponds to higher CO_2, a very high efficiency can be carried in commercial service.

One of the best means for overcoming any difficulty due to low CO_2 in the furnace is having two distinct systems of draught, one an induced-draught system which will always be able to give a sufficient amount of draught to keep the middle portion of the gas space of the boiler at atmospheric pressure, and the forced-draught system, which will blow air, preferably heated air, into the furnace at those positions only where it is required. By this means, there is no possibility of cold air being drawn into the furnace at places where it cannot be utilised, and if leakages from the furnaces do occur, the gas will escape through the boiler casing and show itself up readily, whereas where the boiler is working on a purely induced-draught system, very serious leakages may occur, and can only be discovered by means of an analysis of the gases at various portions of the boiler.

Furnace linings have always given a considerable amount of trouble, and it is still a very difficult matter to find the firebrick that will withstand satisfactorily the high temperatures desired for high-efficiency working. Many manufacturers of first-class firebricks will not guarantee that their firebricks will withstand a working temperature of 3,200° F., and very few bricks indeed will withstand a temperature of 3,500° F.

After all the latest improvements have been collected together to build up a first-class generating plant, there is still a very important element to be reckoned with, namely, the human element. Earlier in the paper it was pointed out that, by varying the CO_2 in the furnace, or, in other words, allowing want of attention, the heat losses going up the chimney may vary between 10 per cent. and 30 per cent. of the total value of the fuel. Allowing a shortage of steam on the turbine neck glands will cause the vacuum on the condenser to drop by quite ½ in. This means about 2½ per cent. increased consumption of steam.

Discussion.

Mr. Gerald Stoney said that the paper was of special interest, as the author was station engineer at Carville, where he had introduced many improvements. In his opinion the disk and drum type was merely a passing fashion; it was not cheaper to build, and its steam consumption was certainly not so good as that of the pure reaction type. The disk and drum type had a certain field, however, where small turbines running at a high speed were necessary, and also in moderate sizes running on very high-pressure steam which could not be taken full advantage of by pure reaction blading. The Parsons turbine had no difficulty in dealing with highly superheated steam, and further, in the pure reaction turbine there was no danger of cutting of the blades, such as sometimes occurred in the impulse type, where there were very high steam velocities. All the recent machines built by his firm (Messrs. Parsons) were of the tandem reaction type with pure Parsons blading, and some of these machines were rated up to 20,000 kw. His experience of condensers led him to believe that a single baffle was as good as three. Where rotary air-pumps were used it was essential that they should be able to stand up to a considerable drop in the vacuum, such as might occur in the event of a large air leakage. Some pumps gave a lot of trouble in this respect. He had often wondered why marine boilers were not more largely used in land practice. The great drawback of the water-tube type lay in the cost of renewals of brickwork and in the large standby losses.

Mr. F. O. Hunt strongly favoured some means of automatically checking the amount of CO_2 in the furnace, and pointed out the importance of reducing air leakages. Knowing exactly what was going on inside the furnace, one could afford to use inferior fuel.

Mr. W. M. Selvey could not agree with Mr. Stoney that the disk and drum type of turbine was merely a passing fashion. A good reason for adopting the disk, apart from a mechanical and superheat point of view, would be found if one calculated the leakage of the first two expansions of a Parsons turbine. He agreed that for large machines the pure reaction type would continue to hold the field. The absence of brickwork about a boiler made it impossible, on a power station load, to get above 6½ per cent. to 7 per cent. of CO_2 without producing black smoke. It was possible to over-do the production of CO_2 as one eventually turned the furnaces into a coal distillery, and in a recent case this had resulted in the flues being blown down, when the doors were opened. The cost of renewing the brickwork had to be balanced against the economy resulting from a high percentage of CO_2, and up to a certain point it was cheaper to burn the arches down. In the same way the Germans believed that it paid to push superheats up to 350° C. and over, at the expense of frequent renewals of the tubes.

Mr. C. S. Vesey-Brown could not agree that a rotary air pump was the best thing to depend upon to keep a station running. Under breakdown conditions the jet condenser might give a vacuum of 1 in. only, but still, that was better than nothing. One great advantage of the water-tube boiler was that it could follow variations of load, due to fog or other causes, and, if necessary, it could be forced without fear of collapse.

Mr. Jackson (in reply) agreed that the pure reaction turbine would hold its own in the larger sizes. The great advantage of the disk and drum type was that it allowed the boilers to be worked at a high superheat, and this was important when one remembered that every 10° of superheat meant an increase of 1 per cent. in the efficiency. He considered that the disk and drum type was best up to 5,000 kw. He had had some years' experience with vacuum augmenter air pumps, and had found that they were as efficient as many rotary air pumps, and quite as good on overloads. The reciprocating air pump was heavy to maintain, and, on the other hand, the kinetic air pump, as described in the paper, would deal with heavy air overloads and still maintain a high vacuum. Marine boilers were not suitable for variable loads on account of the difficulty in getting up the circulation, and it was impossible to get a high duty without producing black smoke. He agreed that the records from CO_2 machines were very valuable, but, unfortunately, the latter were difficult to keep in order.

Electrical Furnaces.

On January 27th, a paper was read on this subject by Mr. Cecil Myers, before a joint meeting of the Manchester Association of Engineers and the Institution of Electrical Engineers (Manchester Local Section). The author dealt only with electric furnaces as applied to the manufacture of steel and steel alloys, and said that the users of the different types of furnaces claimed now to be making tool steel, structural steel, war materials, high-silicon dynamo steel, drawn tubes, steel castings and high quality rails, &c. He explained that the energy of an electric current might be converted into heat in various ways, all really by putting a resistance in its path, and the heat might be concentrated at a special part of the circuit by making the resistance of other parts small in comparison. This was the principle on which electric furnaces were built. If the resistance was a solid or liquid then the process was called resistance heating, but if the resistance consisted of gases only, it was called arc heating. The author then described the electric furnaces employed in the manufacture of steel, and said that in June, 1910, there were about 118 furnaces of all types, of which 70 were in use, 10 not working, and 38 being built. There were 77 of the arc furnace recorded, of which 29 were Heroult, 17 Girod, 13 Stassano, 6 Keller, and 9 others. There was one furnace at Domnarfvet, Sweden, for the production of 2,500 tons of pig-iron per annum; also one in Norway, and one at Trollhattan, Sweden, both in course of construction, and each designed to produce about 7,500 tons of pig-iron annually.

Of the Heroult furnaces, the total capacity per charge of those working was about 80 tons, of those in course of construction about 50 tons. The total capacity of the Girod furnaces (the great competitors of the Heroult) was recorded at about 30 tons for those in work and 26 tons for those being built. Similarly, the figures for the Keller were 13 tons and 8 tons, and for the others 20 tons and 13 tons respectively.

Of the induction furnaces, the Kjellin furnaces erected totalled 14, with 35 tons capacity: and the Rochling-Rodenhauser 15, with 30 tons. That gave a total capacity of about 250 tons for the 11 arc furnaces, and 100 tons for the induction, or a grand total of 350 tons per charge for all electric steel melting furnaces.

In September, 1911, there were 43 Heroult furnaces, with a total capacity of about 242 tons.

The output of electric steel in Germany, the United States, Austria and Hungary, in 1910, amounted to about 112,000 tons, an increase of 63,000 tons over the figures for 1909.

Before the beginning of 1911, the Heroult furnace at Edgar Allen and Co.'s, in Sheffield, was the only arc furnace in steady operation. In January three Heroult furnaces were commenced in England, at Messrs. Vickers and Thomas Firth & Sons, Sheffield, and at Lake & Elliott's, Braintree, Essex. A Kjellin furnace, for demonstration and manufacturing purposes also, started at about the same time in Sheffield, and the output of England for 1911 should amount to about 13,000 tons.

A 15-ton Heroult furnace was now working, or just about to do so, at Skinningrove, and was expected to turn out 200 tons per day. Kjellin induction furnaces also had been working during this period satisfactorily at Messrs. Vickers and at Messrs. Jessop's, in Sheffield, and an experimental furnace at the University of Sheffield. Great progress was expected to be made in Germany with electric furnaces during this year, when Heroult furnaces of 25 and 22 tons capacity per charge were to be constructed. In September, 1911, the largest size was two 15-ton Heroult furnaces at South Chicago and Worcester, belonging to the United States Steel Corporation, who had recently acquired the Heroult patents for America and would probably erect several more furnaces shortly.

Dealing with the chemical actions that took place during the refining, the dephosphorising and the desulphurising of the steel in the bath, the author said:—

The action takes place in two stages; in the first, which is the oxidation period, the carbon, silicon, manganese and phosphorus are oxidised, and in the second, which is the deoxidation period, the metal is dead melted and the sulphur eliminated. The first action is arrived at by adding to the charge certain quantities of lime and oxide of iron, which under the influence of the high temperature oxidise the carbon, silicon and manganese and remove the phosphorus as calcium phosphate. The slag after this operation is removed from the bath and further quantities of lime (and sometimes carbon) are added; this is the second stage, when the sulphur passes into the slag as calcium sulphide, which is not soluble in the metal bath. In the open-hearth furnace this calcium sulphide would very readily be oxidised into calcium sulphate, which would combine with the iron to form sulphide of iron and so go back into the steel. In the reducing atmosphere of the electric furnace this cannot take place, so that it is possible to remove the sulphur to almost any extent.

There is very little doubt that for many purposes in steel making, the electric furnace is the furnace of the future. There is no doubt now in the minds of steel makers who have had actual experience with up-to-date furances, that it is possible to make steel equal to the best ever produced in Sheffield at less cost than it can be done in the crucible.

Mr. F. W. Harbord, one of the leading metallurgists of the day, wrote even in 1909 the following:—

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"Under favourable conditions as to cost of raw materials, especially if a surplus of blast furnace gas is available for generating energy, ferro-silicon and similar alloys can be produced at a cost to compare favourably with imported material produced from water-power. With regard to pig-iron, this can be produced of any grade and of satisfactory quality, but the electric furnace cannot compete commercially with the blast furnace under the conditions existing in this and other countries, where fuel is cheap; but there is a considerable field for its development in countries where cheap water-power is available, and where, owing to suitable fuel for the blast furnace being unobtainable and other conditions, the latter is impossible."

Discussion.

Mr. J. P. Bedson said there was not much to choose between the electric and open-hearth methods except perhaps that the electric process was more under control. Regarding quality of metal, he had made tests on both processes and found very little difference in the results. As a user of high-grade steel, he thought the electric furnace had a future. Electric methods were employed for tempering steel card wire with excellent results.

Mr. Cramp said that in connection with the Rochling-Rodenhauser furnace, mention was made of the rotation of the metal due to the three-phase current, and he would like to ask whether, though that might be a very valuable thing from the point of view of mixing the metal, it might not also result in reduced temperature, since it was well known that directly the metal began to rotate, the eddy currents would be reduced therein. There would be some sort of limit to rotation as far as efficiency was concerned. He would also like to know the frequency of the current supplied to the furnace and the frequency of rotation obtained.

Mr. F. Foster said that his own firm, Messrs. Galloway, and their German friends, Messrs. Ehrhardt & Sehmer, had installed large gas engines supplying current to electric furnaces in this country and abroad. In connection with a recent inquiry, a very careful investigation had been made into the cost of power for similar purposes, the data obtained from the above plants being used as a basis. The figures obtained were carefully checked by independent authorities, and showed that it was possible to generate electric current at a total cost of 0·15d. per unit, when using gas producers and ammonia recovery, with coal at 8s. 6d. per ton. With blast furnace, coke oven, or other waste gases, the total cost of generation fell to about 0·1d. per unit. These costs included capital outlay charges on the whole plant on a very liberal scale, and all labour, repairs, stores, water, fuel, &c. In connection with the electric steel furnaces, a certain amount of transmission and transformation apparatus would be required, and in general the plant would not be running continuously at full load 24 hours a day. These facts would, of course, increase the total cost of electric power, but after making due allowance for these factors, it orght to be possible, with furnaces of large capacity, to deliver electric power at the furnaces at a cost of 0·25d. per unit when using producer gas and 0·2d. per unit when using waste gases. Assuming the higher figure, and that 240 kw.-hours were required for refining 1 ton of steel, the cost of power for refining would amount to 5s. per ton. He found that in general steel of equal quality could be obtained by the older fuel-fired furnace methods. He had always understood, however, that the electric furnace could be more accurately and readily controlled than the ordinary open-hearth or crucible furnace, and that, therefore, it was easier to obtain a high-class product from inferior materials. Thus, in several instances basic steel made from cheap ores was being successfully refined in the electric furnaces so as to give a product fully equal to the best grades of acid steel. This particular process had a further advantage in that the phosphoric slag was a valuable by-product.

Mr. J. Frith said that in general he thought it would pay better to have a separate generating plant for furnace work rather than take energy for it from a public supply; if that were done advantage could be taken of the peculiar conditions of the load to design an alternator which would be much cheaper for its output than the more usual types, which were limited by the necessity for a good pressure regulation. What was wanted for furnace work was constant kw. output rather than constant pressure; this would more than counter-balance the increased cost due to the low frequency which suited furnace work best.

Mr. E. C. Ibbotson said that in his experience the consumption for a given amount of refining was practically the same for the arc and induction furnace. From a design point of view, the induction furnace with the plain roof was perhaps better than the arc furnace with carbon electrodes projecting through the roof. Against the higher power factor obtained in the arc over the induction furnace, the latter had the advantage of no sudden changes of load to which arc furnaces were liable. In the speaker's opinion the high temperature of the arc had a bad effect upon the quality of steel, particularly high-carbon steels. The metallic loss was greater in the arc than in the induction furnace. In the case of the arc furnace a pressure of less than 100 volts was required, whereas any pressure could easily be adapted to the induction furnace. Single-phase supply seemed to give the best results. Regarding the starting of furnaces, the arc would start from cold, but in the case of the induction furnace a start was made from a wrought-iron ring which was used initially to dry the roof. Usually some of the charge was left in the furnace for starting except in the case of furnaces using liquid fuel, which could be run dry and recharged without difficulty.

Mr. C. K. Everitt said he had had considerable experience with the Héroult arc furnace with a fair measure of success. The supply used was from the Corporation mains at 2,000 volts, 50 cycles, this being converted to 100 volts, 28 cycles, for furnace working. The fact that the electrodes penetrated the roof of the furnace was an advantage, as the direct radiation from the arc was more on the carbon electrodes than on the roof lining. A refining furnace roof usually lasted three to four weeks. In England electrical furnaces were suitable for refining only, as they were most uneconomical as melting furnaces. One furnace under the speaker's observation employed a slag on the top of the molten metal, which could be taken off or replaced as required. This slag cover was a great help, especially in making alloy steel, where it was necessary to introduce certain percentages of other metals. The speaker had not encountered any sign of danger owing to the high temperature of the arc. It was to be remembered that the arc did not play directly on the metal, but upon the slag covering the metal.

Mr. C. Myers, in reply, said he was of opinion that steel could be made as good in the electrical furnaces as in the ordinary furnaces. The electric furnace could make a very high quality of steel with a low quality of raw material. The idea in making a high quality of steel in most processes was to get as near as possible to pure iron.

Mr. C. W. Johansen (Communicated):—The electric steel furnaces will be of the greatest importance for countries like Norway and Sweden, but particularly Norway, which possesses large quantities of low grade ore containing about 30-36 per cent. of iron. During the last few years extensive works have been put up in order to concentrate this ore to contain about 67 per cent. of iron for export. However, since the electric furnace has proved to be a technical and probably a commercial success, considerable interest and capital have been devoted to this subject, in order to export the finished product in the form of steel instead of the concentrated ore. Contrary to the conclusion the author came to, that the electric steel furnace could only compete with the crucibles in refining the steel, but not with the Bessemer and Martin furnaces themselves, the opinion seems to prevail in Norway that steel somewhat superior in quality to the Bessemer or Martin steel can be manufactured with profit in electric steel furnaces directly from pig-iron, and consequently a better price can be obtained for the same than is usually paid for Bessemer or Martin steel. New works which have recently been put up have based their calculations on a selling price of £7 15s. per ton, delivered at an English port, for their steel in the form of billets. Two steel works have recently come into operation in Norway, and further plants are under construction. In the above plants pig-iron is made in one electric furnace from ore and the refining process takes place in another. Water-power stations have in many instances been built at a cost of about £11 per electrical horse-power, which means slightly more than £1 per H.P.-year, making ordinary allowances for interest, depreciation and maintenance; this is for power delivered at the works. An instance has also been quoted where the electrical power cost 16s. per H.P.-year. A prominent Norwegian metallurgist has come to the conclusion that 350 million tons of low grade ore is available in Norway, without going to any considerable depth. The Commission appointed by the Norwegian Government came to the conclusion that the most suitable periodicity will be found by a compromise between cost of electrical plant and reasonable power factor, and will have to be considered for each special case. An electric blast furnace has been in operation for some time in Norway, and is giving good results. Ore of 46-48 per cent. iron was used and the size of furnace was 500 H.P.; 460 tons was produced, and an average selling price of £3 12s. to £3 15s. per ton was obtained for the product. Based on this experiment, the Tinfos Iron Works, Ltd., was organised early in 1911, and will shortly come into operation.

Domestic Electricity.

(*Second Informal Discussion at the* Institution of Electrical Engineers, *London, April 18th*, 1912.)

Mr. W. M. Mordey, the first speaker, said he wished to remove any impression that the extension of the use of electricity was not being maintained satisfactorily. Its progress could best be gathered by a comparison between the results obtained by groups of similar sized undertakings (taking six in each class) for the years 1908 and 1910-11. In the case of the London local authorities the average consumption per head in 1908 was 25 units; it was now 39 units. The comparative prices were 2·45d. and 1·96d. per unit. In the case of the London supply companies these figures were 52 units and 75 units per head, and 3·1d. and 2·4d. per unit respectively. Taking groups of towns, and excluding tramways supply:—

Six large towns show an increase of 54 % in consumption.
" " a decrease of 27 % in price.
Six medium towns show an increase of 32 % in consumption.
" " a decrease of 6 % in price.
Six small towns show an increase of 40 % in consumption.
" " a decrease of 20 % in price,

over the same years as were taken for London. These figures were, he considered, very satisfactory for three years' progress.

Mr. Frank Bailey said cheap electricity supply was an essential to its extended use; he traced briefly the influence of the companies' early installations of plant in keeping the price higher than it would otherwise have been, owing to the necessity of "scrapping," pointing out the difficulty of obtaining new capital, which might possibly be remedied if we possessed industrial banks or similar institutions. He thought the time had arrived when supply authorities could hire out apparatus with confidence. There were now 5,000 or 6,000 electric radiators in use in the City

of London, and although the price for such supply (2½d. per unit) seemed high, it competed with the coal fire in offices, and was favoured by architects owing to the simpler buildings which could be used.

Mr. Hugo Hirst agreed with the first speaker as to the progress which had been made, but it seemed that we might do better. In his opinion, one principal hindrance to rapid development of the electricity supply had been municipal ownership, which had led to development on narrow lines, within artificial boundaries, and irrespective of the engineering or commercial aspects of the case. The many small stations and different supply systems of political (not engineering) origin, hindered both electricity supply and manufacturing, and a broader policy was required. We could not expect the same co-operation as in America, but we ought to make a combined effort to further electricity supply, and the promised industrial committee could do a great deal to facilitate this.

Mr. F. C. Raphael, in the course of a spirited speech, deprecated the custom of depreciating electrical affairs, and exaggerating possible deficiences, which appeared to prevail amongst electrical men—instancing many remarks made during the previous discussion. One possible reason for this was that we were "amateur" commercial men. The central station man complained of the overlapping of cooking and lighting loads, but he (the speaker) thought he hardly appreciated the position, instancing the fact that gas cookers came into use owing to their convenience during the warm weather, when fires were not wanted. The electrical cooker which would be used in the same way, would be in evidence during the period of lightest load on the supply station, and he failed to grasp the objection to it. Of the various systems of charging for energy the one propounded by Mr. Lackie was ideal, although it might possibly be improved on. He advocated the hiring out of cooking apparatus at competitive rates, and pointed out that the objection sometimes made to extra wiring for an electric stove, also applied to a gas stove, which needed special piping in the first instance. He thought straightforward advertising in the daily papers was the best method of getting at possible consumers, but felt that much of the Publicity Committee's energy was being applied in the wrong direction.

Mr. A. H. Seabrook considered that lack of conviction and knowledge on the part of electrical men were the greatest hindrance to extended electricity supply. He deplored the fact that so much rubbish was spoken and written on the subject by electrical engineers. At the Smoke Abatement Exhibition the electrical restaurant had supplied 4,000 people with meals in 11 days, and the metered energy, which was freely used for lamps, radiators, cooking and hot water supply, only amounted to 3,600 units, so that the cost of energy was not worth worrying about. A firm of commercial caterers in Marylebone were supplying 500 people daily with three-course meals electrically cooked at 4d. each, in view of which it did not appear that this method could be expensive. The more he saw of the incidence of the lighting and cooking loads, the more he felt that engineers who offered very low secondary rates (including Southampton and Sunderland, where the secondary charge was ½d. per unit) were in the right. Touching on the question of carrying capacity of existing wiring, he had never yet had to increase any cable sizes where electrical heating or cooking was adopted in Marylebone.

Mr. B. M. Jenkin considered that the maximum-demand system of charging was the curse of supply work from the consumers' point of view. As was intended by the engineer, it did keep the small short-hour consumer off his mains. But the engineer was wrong; what was wanted was a diversity indicator, and Mr. Lackie used an ampere-hour meter for this purpose. It was discouraging to a prospective consumer to have to purchase outright apparatus and run wiring on a separate meter, without knowing the ultimate cost of the venture; the cost of energy per unit was no guide; what was wanted was the overall cost per quarter, together with a free trial of apparatus.

Mr. R. W. Hughman said supply engineers displayed a lack of enthusiasm for their own commodity, but electricity was always the best although not always the cheapest. If they reversed matters, and imagined themselves members of the gas industry looking at the progress of electricity, he thought it would be agreed that that progress was very great indeed. He believed that a combined "publicity week" movement, supported by the Institution and leading electrical associations, would have a very great effect.

Mr. C. P. Sparks made a comparison between the early days of power supply work, when very similar causes to those now operating against electrical heating and cooking, held back power supply. Factors such as high cost of apparatus, lack of knowledge, tariff, &c., were then the drawbacks, but apparatus for power work now cost only one-quarter to one-third of what it did then. He did not agree with the views expressed on newspaper advertising or with picture postcards, but regarded the permanent showroom demonstration as the most efficient way of reaching the public. In the motive power business a special effort was made with suitable terms in order to get the early consumers, and in this way some knowledge of the business was gained. He did not consider it financially safe to hire out cooking apparatus in its present state of development on similar lines to the motor, while as to cost of energy, this was not so material to the domestic consumer as the question of comfort and convenience. He concluded by advocating co-operation between the supply engineer and manufacturer in regard to apparatus and the institution of suitable showrooms for displaying it and demonstrating its use.

Mr. H. Faraday Proctor said ignorance and lack of enthusiasm were the greatest bar to progress now, and a remedy would be to allow all supply authorities to provide any kind of apparatus which the consumer might ask for. One drawback in the case of municipal supply work was the mixed constitution of electricity committees and the influence which outside matters had on their work. He suggested that this could only be overcome by transferring such undertakings to the management of local trusts composed of men with no particular axes to grind.

Mr. W. E. Warrilow deduced from the fact that £400,000 per annum was spent annually in the States on newspaper advertising, that a satisfactory standard of apparatus had been obtained there. He also urged the co-ordination of advertising effort in the electrical business, something on the lines of the British Commercial Gas Association's work.

Mr. L. L. Robinson (Hackney) said many engineers had to spend more time in pushing on their committees than in pushing the supply. The West Ham undertaking was an example of what enthusiasm could do in a few years; the load factor there was 31·9 per cent. Amongst other things, the electrical contractor was to blame for the restricted development of electric heating and cooking. The wiring contractors had succeeded in getting a clause inserted in the Hackney Bill, which quite prevented the local supply authorities from quoting suitable hire rates for cooking apparatus, and they had, incidentally, lost a great amount of wiring work thereby. On the question of price, it had required Mr. Merz to show London how much the price could be reduced for power purposes, and bankruptcy had not yet resulted from this.

Mr. A. F. Harrison, of the Publicity Committee, defended its work, pointing out that it had 250 of the 500 authorities on its books, as well as customers in India, Australia, and Canada. Evidently, therefore, the Committee's work was appreciated. The Committee would be glad to co-operate with the other Associations and the Institution, and it had done so at the Smoke Abatement Exhibition with great success. He thought, perhaps, a travelling exhibition on similar lines to that would be useful. The Committee was about to start in new premises, conveniently situated, with a small permanent exhibition of apparatus. Newspaper advertising was purely a matter of money, and he hoped the next appeal for funds would meet with more generous support than the last.

The President here announced that as there were many more wishing to speak on this subject, a third evening—May 2nd—would be given up to it.

Wireless Telegraphy and Aviation.—From time to time to time we have reported various experiments which have been made concerning the transmission of messages from, and the reception of signals by, air-ships of different types. The importance of being able to effect such intercommunication hardly needs explanation; in the case of dirigibles, ability to rapidly convey precise instructions as to preparations to be made for landing may well be the means of avoiding a serious disaster, and for military and naval purposes, half the value of an air-vessel, of whatever kind, is lost if the information gathered during a reconnaissance cannot be quickly transferred to headquarters. In case of foggy weather, or during night flights, an aeroplane will undoubtedly, in future, be able to keep its bearings by the interchange of wireless signals with headquarters, and a little consideration will suggest innumerable other contingencies in which the utility and safety of airships—indeed, the very practicability of flight—depend on communication which, so far as we are able to judge, can be provided by no other means than wireless telegraphy. Slow but steady progress has been made in the design of apparatus for use on board dirigibles and aeroplanes. In either case, there is no special difficulty in receiving messages from a land station, but in order that messages may also be transmitted, a very simple, robust, and powerful equipment must be employed, and particularly in the case of aeroplanes, weight must be kept to an absolute minimum.

Among the exhibits at the recent Airship Exhibition at Berlin, were a number of wireless sets specially designed for this service, and including:—(1) Receiving apparatus of specially low weight, so constructed that the most delicate parts were well protected from accidental injury (especially by the shock of a bad "landing"); (2) a complete transmitting and receiving equipment for aeroplanes, in the design of which primary importance was attached to simplicity, lightness, compactness and strength; (3) a dirigible equipment, similar to the last, but heavier, and of greater effective range; (4) the "Telefunkenkompass," designed to aid the navigation of air vessels.

Daily demonstrations were carried out with the latter instrument in the Exhibition hall, the bearings of a station at Spandau being determined. The system employed involves no special receiving apparatus, and necessitates no calculation or other involved process to determine the bearings of the land station from the signals observed. The only additional equipment required by the aviator is a stop-watch. At the land station which is acting as a bearing point for the air-vessel, a number of horizontal antennæ are arranged as the radii of a "star," and each in turn is connected with the sending apparatus by means of a rotating contact. Special signals are emitted from the aerials lying in the north-south direction and by observing the time between these signals and the time at which the intensity of the received signals is a maximum and minimum (respectively corresponding to the moments in which the direction of the "active" aerial coincides with, and is perpendicular to the direction of the air-vessel from the land station), the aviator can work out mentally an approximate bearing.

TRADE STATISTICS OF JAMAICA.

The following figures, showing the imports of electrical and similar goods into Jamaica during the year 1910, are taken from the official trade statistics recently issued; the figures for the year 1909 are given for purposes of comparison, and notes of any increases or decreases are added.

	1909.	1910.	Increase or decrease.
Electrical apparatus for lighting, and parts thereof.—	£	£	£
From Great Britain	885	503	— 382
„ United States	6,768	6,706	— 62
„ Germany	156	7	— 149
Total	7,809	7,216	— 593
Steam engines, other than agricultural.—			
From Great Britain	6,604	3,852	— 2,752
„ United States	5,029	1,448	— 3,581
„ Germany	251	—	— 251
„ Other countries	105	—	— 105
Total	11,989	5,300	— 6,689
Machinery, other than steam engines, and not agricultural.—			
From Great Britain	4,261	2,084	— 2,177
„ United States	5,266	3,270	— 1,996
„ Germany	60	—	— 60
„ Other countries	11	109	+ 98
Total	9,598	5,463	— 4,135
Railway rails.—			
From Great Britain	—	3,861	+ 3,861
„ United States	108	395	+ 287
„ Germany	—	384	+ 384
Total	108	4,640	+ 4,532
Telegraph and telephone wires and apparatus.—			
From Great Britain	275	448	+ 173
„ United States	569	995	+ 426
„ Other countries	15	—	— 15
Total	859	1,443	+ 584
Earthenware, china-ware, and porcelain.—			
From Great Britain	6,913	8,417	+ 1,504
„ United States	881	432	— 449
„ Germany	1,526	766	— 760
„ Other countries	61	301	+ 240
Total	9,381	9,916	+ 535
Scientific instruments.—			
From Great Britain	1,526	1,412	— 114
„ United States	495	323	— 172
„ Other countries	45	44	— 1
Total	2,066	1,779	— 287
Lamps, &c.—			
From Great Britain	1,487	1,393	— 94
„ United States	2,861	2,981	+ 120
„ Germany	111	137	+ 26
„ Other countries	28	60	+ 32
Total	4,487	4,571	+ 84

EXPIRING PATENTS.

We are informed by Messrs. W. P. Thompson & Co. that about 530 complete applications for electrical patents were filed during the year 1898. Only 54 of the patents granted on these applications have been maintained for their full term, viz., 14 years, and these being of considerable value, we give short abstracts of them below:—

121. January 3rd, 1898. "Measuring electricity." E. Batault. Relates to Meters.—An A.C. motor meter has spindle geared to a counter, carrying a conducting-disk in the spaces in a stationary laminated iron circuit. The magnet is excited by a shunt coil, and its poles are slotted radially to receive series coils, which enclose only part of the section of the iron. The poles may be divided equally or unequally in section, and the series windings may enclose parts both on one side of the magnet, as shown, or one part only, or parts symmetrical about the axis. The arrangement shown, in which the series windings produce like poles at both ends of the magnet, has the advantage that currents induced in the two series coils act oppositely on the disk, so that this is not rotated when no main current is passing.

591. January 9th, 1898. "Microphones." A. Graham. Microphones are constructed so as to be waterproof and to be capable of resisting shocks when used in exposed positions, such as on ships, by divers, &c. A disk of vulcanised fibre carries in a recess a carbon cup with a backing of paper, felt, &c. A carbon and metal diaphragm closes the front of the carbon cup and has its edges preferably soldered to a metal ring. A protective sheet is set in the mouthpiece. The joints are all made good by solder, shellac, or other suitable means.

809. January 11th, 1898. "Calling devices for telephone exchanges." Strowger Automatic Telephone Exchange. (W. P. Thompson.) Relates to calling apparatus by which a subscriber can select any other subscriber wanted on an automatic telephone exchange. A finger disk is mounted on the front end of a tubular shaft which on its inner end carries an escapement disk with pins corresponding to the numbers on the disk. A coiled spring holds the disk in its normal position and allows it slowly to return under the action of an escapement lever after it has been moved through any predetermined angle. The slow return at the same time operates a spring switch to send a number of impulses to line corresponding to the number of pins.

1,535. January 19th, 1898. "Electric Lamps." C. A. Ritter von Welsbach. Relates to incandescent lamps. Filaments are made of osmium, or alloys of this with ruthenium, rhodium, or other platinum metals, or these metals alone, and may be coated with oxides, preferably of thorium or zirconium. They are mounted in bulbs which are exhausted or contain reducing gases, and under these circumstances may be heated to extremely high temperatures, so as to emit a large proportion of lighting rays. An osmium filament may be made by coating a wire of platinum, or other metal having a high melting point, by warming it electrically in an atmosphere containing a volatile osmium compound and a suitable reducing gas, such as a mixture of hydrocarbons and water vapour drawn from the middle of a Bunsen flame; the wire is afterwards slowly heated more highly to consolidate the osmium coating, and finally until the platinum has evaporated, leaving a coherent tubular filament of osmium, which may contain a little platinum. The osmium coating may otherwise be deposited by electrolysis, or by repeatedly painting the wire with a solution containing osmium, preferably made into a paste with finely divided metallic osmium or an osmium compound, and a binding material.

1,589. January 19th, 1898. "Lamps." J. Gunning. Relates to means for extinguishing electric lights after a predetermined time. The invention is described and illustrated in connection with gas lights. To extinguish some of the gas lights before the others, the gas cock has a longitudinal channel communicating with two transverse channels. Arms are fixed at predetermined intervals on the disk of the clockwork mechanism, a shoulder on the disk turning the cock so that the channels respectively register with the gas supply pipes. The clockwork then turns the cock sufficiently to close the channel and extinguish the lights supplied by the pipe.

5,094. March 1st, 1898. "Measuring Electricity." C. O. Bastian. Relates to quantity meters. An electrolytic meter consists of a glass tube containing acidulated water and two platinum electrodes by which the current to be measured or a known fraction of it, is passed through the liquid. The tube is fixed in a case near a scale adjustable vertically and clamped by a nut for setting the zero mark to the top of the liquid when the tube is refilled. The glass frame is made with a vertical centre rod and foot. In one arrangement the electrodes are connected with platinum wires sealed in the tube, the seals being protected by gutta-percha or the like applied outside. In a modified form the glass frame is attached to a tube in which the connecting wires are sealed and insulated.

5,449. March 5th, 1898. "Measuring Electricity." W. Duddell. Relates to current meters, applicable for measuring rapidly varying currents or potential differences, and especially for showing or recording alternating-current wave forms. The current is passed in opposite directions through two parallel thin strips, stretched in narrow spaces between the pole-pieces of a strong magnet. The strips are held on fixed supports above and below the pole-pieces, and at their centres carry a mirror, the deflection of which is measured by that of a light ray, and if small is proportional to the current passing. A thin iron partition is placed between the strips and cut away to receive the mirror: non-magnetic blocks complete spaces which are filled with viscous liquid, to damp the vibration of the strips. For showing alternating wave forms, the light ray from the mirror is reflected by another mirror rotated by a synchronous motor, so as to give a stationary curve on a transparent screen placed near it. This curve may be drawn or photographed. When two quantities are to be observed simultaneously, the instrument is provided with two adjacent measuring strips and mirrors.

6,024. March 11th, 1898. "Conduits for electric conductors." W. Sykes. Conduits are formed of earthenware sections in which a number of circular tubes are formed parallel. The sections fit by spigot-and-socket joints on to and into which have been cast linings, preferably of bituminous material. When the tubes are fitted without previously formed joint liners, a centreing mandrel is employed and the joint is made good with cement. In a further modification the ducts may be in the form of troughs which are filled with bituminous material and covered with flat lids after the cables have been laid.

6,989. March 22nd, 1898. "Measuring electricity." E. Weston. Relates to current meters. Two instruments are mounted on the base and provided with two scales or one common scale on which their needles indicate independently, so that both are readable at the same time. The instruments may be voltmeters or ammeters. The coils are pivoted between insulated non-magnetic bridges and enclose iron cores between the pole pieces of two parallel magnets. The coils carry the pointers and counterweights, and are connected to terminals by flat spiral springs.

6,991. March 22nd, 1898. "Measuring electricity." E. Weston. Relates to current meters having pivoted coils, movable about fixed cylindrical cores between the pole pieces of permanent magnets, said meters being provided with several improvements in details of construction. The pivots, to engage in bearing jewels, are supported on the movable coil. Each support is made by turning down the end of an aluminium bar to two smaller diameters drilling the end to receive the pin, which is forced into it, screw threading the smallest part to receive a nut and milling flat sides on the intermediate part to receive a pointer; a thin piece of the end of the bar is then cut off, forming a plate which can be cemented on the coil.

6,991A. March 22nd, 1898. "Pointers for instruments." E. Weston. Electrical and other measuring instruments are provided with light metallic pointers which can be accurately counterbalanced so as to remain in definite positions in any position of the instrument. A cross-piece is cut from aluminium sheet, with four narrow arms, and a central slot to fit the spindle of the instrument. In one form three arms are screw threaded to carry adjustable balance weights. Each weight is a short tube screw threaded internally at one end, the plain part serving as a guide in placing it on the arm; the screw-threaded part is either made of smaller bore than the plain part, or is split and compressed. In a modification the point is formed of a piece of thin sheet aluminium which is stamped with a corrugation to stiffen it.

7,196. March 24th, 1898. "Explosion engines." F. R. Simms. Relates to the ignition of internal combustion engines. An electrical contact is broken by a snail cam, and the angular position of the cam on the shaft is altered to control the speed. The half-speed counter-shaft drives another shaft at same speed. This shaft carries the snail cams for operating the contact breakers, and has a helical feather that works in the wheel, so that by moving the shaft longitudinally its angular position is altered. A wheel on the shaft gears with a long pinion of half its size, turning freely on the shaft, and carrying an eccentric that actuates synchronously with the contact-breakers the oscillating envelope between the fixed armature and field magnets of a dynamo.

7,298. March 25th, 1898. "Relates to lighting and extinguishing gas." G. Lentschat. The gas supply is controlled by a rotary disk valve actuated by the armature of an electromagnet. The disk valve is formed with series of ratchet teeth and holes, and at each passage of the electric current is turned to the extent of one tooth by a pawl on the pivoted armature. When the holes coincide with the channels the gas is on, and when the wheel is moved one tooth the channels are closed by the solid parts of the disk, and the gas is cut off. By varying the number of holes relatively to the number of teeth a number of street or other lamps may be either ignited simultaneously and extinguished in consecutive groups, or ignited in consecutive groups and extinguished simultaneously.

7,470. March 28th, 1898. "Electrolysis." W. L. Wise. (Solvay & Co.) Relates to the electrolysis of alkaline chlorides and other salts by the use of mercury cathode. The tank is provided with a layer of mercury which continuously overflows at the adjustable weir, carrying with it the amalgam formed, and thereby always presenting a clean surface. It then passes to another which may be a similar electrolytic apparatus in which the mercury is regenerated. The mercury is raised by an elevator or a pump and enters the well at the opposite end to the weir. This circulation is continuous. When it is desired to clean out the cell, one end may be raised by a screw. The electrolyte is preferably caused to continuously flow in the same direction as the top mercury layer.

7,471. March 28th, 1898. "Electrolysis." W. L. Wise. (Solvay & Co.) For the purpose of obtaining the maximum output in the electrolysis of an alkaline chloride by means of a mercury cathode, the electrolyte is composed of two layers. The lower one, of great density, lies on the mercury and is practically free from chlorine. The upper one, of small density, lies on the former layer, contains the anode or anodes, and becomes saturated with chlorine.

8,274. April 7th, 1898. "Electric bells." H. Oppenheimer. A bell for use in mines, chemical works, dye works, breweries, &c., has the armature and hammer mounted on opposite ends of a pin which is passed through the base, gas-tight and liquid-tight, either by grooving and packing the pin or passing it through a gland stuffing box. The cover is packed with a paraffined cord, &c., and the terminals are insulated in a cast-iron box filled with paraffin wax, and provided with a cover. The armature is held clear of the magnet by a spring and is balanced by the hammer.

8,882. April 15th, 1898. "Electricity measuring clocks." C. E. O'Keenan. Commutator motor meters are made with disk or cylinder armatures, containing no conducting materials except their coils, and no moving iron. These move in constant magnetic fields produced by permanent or electromagnets, the latter being laminated for use with alternating currents. The armatures are connected in parallel with fixed resistances, which are made non-inductive and of material having small temperature variations. Friction is compensated by placing a resistance in series with the armature, and connecting a point between this resistance and the armature through another resistance with the second supply main, so that a small current passes constantly through the armature. To register merely the time during which current is supplied, the field of a quantity meter may be produced by an unsaturated electromagnet carrying the main current so that the armature has the same velocity with any current. A quantity meter may be supplied with current from a battery of constant voltage to serve as a clock. On a constant current supply system a quantity meter may be connected between the mains, a high resistance being used in parallel with the armature. Other energy meters may be constructed similarly to the quantity meters, the fields being produced wholly or partly by unsaturated electromagnets connected between the mains; the armatures carry the main currents. Such an instrument may be used with continuous or alternating current as a lamp hour meter.

(To be continued.)

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

8,286. "Electric leakage indicators." R. M. Marshall. April 6th.

8,327. "Electric igniters." J. Born. (Convention date, April 7th, 1911, France.) April 6th. (Complete.)

8,340. "Ignition apparatus." O. Schlick. April 6th. (Complete.)

8,352. "Electric telegraph transmitting systems and apparatus therefor." E. R. Barker. April 9th.

8,443. "Means for leading electric and other power into revolving structures." R. H. S. Bacon and F. W. H. Shepherd. April 9th.

8,491. "Electric charging apparatus." J. D. Oligny. April 10th.

8,526. "Planimeters." British Thomson-Houston Co., Ltd. April 10th.

8,542. "Sparking plugs." R. F. Hall. April 11th.

8,559. "Arrangement for determining position by means of electromagnetic waves." W. P. Thompson. (Ges. fur Drahtlose Telegraphie m.b.H., Germany.) April 11th. (Complete.)

8,561. "Apparatus for the electric lighting of railway trains and like purposes." J. R. Johnstone. April 11th.

8,566. "Arrangement and sealing of electric conductors into mercury vapour electric apparatus and the like." Brush Electrical Engineering Co., Ltd., G. T. Wood and A. E. Salisbury. April 11th.

8,569. "Protective devices for electric distribution systems." British Thomson-Houston Co., Ltd., and E. B. Wedmore. April 11th.

8,571. "Manual and semi-automatic telephone exchange systems." F. R. McBerty. (Divided application on 17,211/11. Convention date, July 27th, 1910, United States.) April 11th. (Complete.)

8,572. "Automatic or semi-automatic telephone exchange systems." F. R. McBerty. (Divided application No. 17,211/11. Convention date, July 27th, 1910, United States.) April 11th. (Complete.)

8,573. "Automatic or semi-automatic telephone exchange systems." F. R. McBerty. (Divided application on 17,211/11. (Convention date, July 27th, 1910, United States.) April 11th. (Complete.)

8,579. "Electric induction furnaces." H. G. Solomon. April 11th.

8,590. "Automatic protection device for electric circuits." P. M. Levy and H. T. George. April 11th. (Complete.)

8,611. "Electric motor control systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 11th.

8,637. "Sparking-plug for motors, aeroplanes, and the like." J. Dudley and J. Humpage. April 11th.

8,640. "Slip-ring collector devices for electrical instruments and machines." A. Denny and F. T. Edgecombe. April 12th.

8,677. "Electric cigar-lighters." L. T. Dixon. April 13th.

8,678. "Electromagnetically operated switches, particularly adapted for controlling electric motors." E. Schattner. April 13th. (Complete.)

8,682. "Electrical geysers and the heating elements for same, which same elements can also be applied to other types of electrical heating and radiating apparatus." C. R. Belling. April 12th.

8,695. "Memorandum pad for use with table telephone instruments." J. G. Hay. April 12th.

8,714. "Electric signal switch." C. Beck and A. Beck. April 12th. (Complete.)

8,719. "Electric soldering irons." A. Fletcher. April 12th.

8,724. "Electrical measuring instruments." B. Thomson-Houston Co., Ltd., and F. Holden. April 13th.

8,728. "Construction of electric lamp holders." R. N. Cunningham. April 12th.

8,740. "Construction of electro-magnets, transformers or induction coils." R. S. Wright. April 13th.

8,745. "Electric resistances or dimmers for use in governing the flow of current through incandescent lamps." E. T. Middlemiss. April 13th.

8,746. "Electrotype and process for the production thereof." J. Muray. April 13th.

8,757. "Tungsten powder for the production of incandescent bodies and a process of manufacturing same." J. Hubers. (Julius Pintsch Akt.-Ges., Germany.) April 13th.

8,758. "Tungsten or the like metal-filament and a process of manufacturing same." J. Hubers. (Julius Pintsch Akt.-Ges., Germany.) April 13th.

8,767. "Form of zinc for galvanic batteries." E. E. Moore. April 13th.

8,790. "Electric refining crucibles." E. C. R. Marks. (Patents Purchasing Co., United States.) April 13th. (Complete.)

8,791. "Electric arc furnaces." E. C. R. Marks. (Patents Purchasing Co., United States.) April 13th. (Complete.)

8,793. "Telephone relays and repeaters." F. A. Stirrup. April 13th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Self-Regulating Dynamo-Electric Machines. A. H. Vandervell and C. A. Midgley. 29,493. December 30th. (Patent of Addition not granted.)

1911.

Ignition System for Internal-Combustion Engines. C. F. Kettering. 5,902. March 9th. (March 12th, 1910.)

Apparatus for Generating Electricity on Motor-Driven Vehicles and the like. H. F. Joel and J. Taylor. 6,257. March 13th.

Control Systems for Electric Hoisting Apparatus. Allgemeine Electricitäts Ges. 6,293. March 13th. (March 12th, 1910.)

Multiple Telephony. E. Ruhmer. 6,549. March 15th. (March 16th, 1910.)

Electrical Signs, Advertising Devices and the like. G. Wallace and J. E. Graham. 6,863. March 18th.

Electrodes for Flame Arc Lamps or the like. Oliver Arc Lamp, Ltd., C. Oliver and W. M. D. Pell. 6,986. March 20th.

Electrostatic Measuring Instruments. G. L. Addenbrooke. 9,077. April 12th.

Apparatus for Removing Boiler-Scale and the like. Electric Safety Boiler Cleaner, Ltd., and W. Ardill. 9,567. April 19th.

Electromagnetic Levitating and Transmitting Apparatus. E. Bachelet. 9,573. April 19th.

Remote Control Systems for Electrically-Driven Vehicles. Electromotoren Werke Hermann Gradenwitz. 10,550. May 1st. (May 27th, 1910.)

Method of Feeding Low-Voltage Lamps and other Low-Voltage Electrical Devices in a High-Voltage Net. L. Neu. 10,965. May 6th. (July 7th, 1910.)

Telephone Instruments. H. G. Matthews. 12,780. May 26th.

Electrical Accumulators for Ignition, Traction, Lighting and other purposes. J. Bayley and S. Wood. 13,266. June 2nd.

Electric Relays. W. R. Sykes's Interlocking Signal Co., J. C. Sykes and R. W. Tarrant. 14,615. June 20th.

Electric Ignition Fuses. Schaffler rekte Glössl and D. Weiss. 15,219. June 29th.

Circuits for Telephone Instruments. British Insulated and Helsby Cables, Ltd., and J. B. Redfern. 15,502. July 4th.

Electric Motor Control Systems. British Thomson-Houston Co. (General Electric Co.) 15,841. July 7th.

Telephone Exchange Circuits. Western Electric Co. (Western Electric Co.) 18,649. August 18th.

Electrical Tell-Tale Apparatus for Watchmen and the like. H. Lake. (F. Williams.) 19,313. August 29th.

Impulse Transmitters for Automatic Exchange Telephone Systems. G. A. Betulander. 19,661. September 4th. (September 5th, 1910.)

Electromagnetic Valves for Gas Apparatus. E. Tellier and Compagnie Anon. des Allumeurs Extincteurs du Gaz a Distance Systeme Gote. 20,403. September 14th.

Electrolytic Deposition of Metals, particularly upon Iron and Steel Surfaces. Q. Marino and P. Marino. 22,141. October 7th.

Means for Operating Tramway Points or Switches. M. Renner. 24,581. November 4th.

Buffer Machines used in connection with Electrical Buffers. Siemens-Schuckertwerke Ges. 24,744. November 7th. (November 8th, 1910.)

Method and Furnace for Reduction or Smelting of Ore with Electric Current. Aktiebolaget Elektrometall. 25,862. November 20th. (November 25th, 1910.)

Gas-Detecting Apparatus for Portable Electric Hand-Lamps. G. J. Ralph and J. H. Holmes. 6,364. March 14th.

Sterilising Liquids by Means of Ultra-Violet Rays. M. von Recklinghausen. 6,759. March 17th.

Incandescent Electric Lamps. J. T. Robin. 6,856. March 18th.

Electrodes for Flame Arc Lamps. Oliver Arc Lamp, Ltd., C. Oliver and W. M. D. Pell. 6,984. March 20th.

Electric Lampholders. L. M. Waterhouse. 7,161. March 22nd.

Magneto Trip Mechanism for Internal-Combustion Engines. K. E. L. Guinness. 7,876. March 24th.

Controllers for Electric Motors. J. Smith. 10,219. April 27th.

Intercommunication Telephone Systems. Sterling Telephone and Electric Co. and F. G. Bell. 11,237. May 9th. (Addition to 1,631 of 1910.)

Telephone Signalling Systems. C. H. Ellison and C. M. Jacobs. 12,175. May 20th.

Plug and Socket Connections, Electrical. A. P. Lundberg, C. C. Lundberg and P. A. Lundberg. 12,225. May 20th.

Electrically Operated or Controlled Indicating Apparatus for use with Signalling Apparatus on Railways. A. H. Johnson and J. P. O'Donnell. 12,833. May 29th.

Electrically Operated or Controlled Indicating Apparatus for use with Signalling Apparatus on Railways. J. T. Russell and C. S. Saunders. 12,941. May 30th.

1912.

Safety Fuses for Electrical Installations. Appareillage Gardy (S.A.). 3,121. February 7th. (February 23rd, 1911.)

Sanitary Protectors for Telephone Transmitters. C. Adams. 3,288. January 29th.

Watertight Terminal for Electric Cables. Firm of Robert Bosch. 3,638. February 6th. (February 20th, 1911.)